WORK PLAN
PHASE II SITE INVESTIGATION
NAVISTAR INTERNATIONAL TRANSPORTATION COMPANY/ BURLINGTON NORTHERN RAILROAD/ IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

June 1994

Prepared for

Navistar International Transportation Corporation
455 North Cityfront Plaza Drive
Chicago, Illinois 60601

and

Burlington Northern Railroad
4105 North Lexington Avenue, Suite 300
Arden Hills, Minnesota 55126-6181

Prepared by

Geraghty & Miller, Inc.
35 East Wacker Drive, Suite 1000
Chicago, Illinois 60601

WORK PLAN
PHASE II SITE INVESTIGATION
NAVISTAR INTERNATIONAL TRANSPORTATION COMPANY/
BURLINGTON NORTHERN RAILROAD/
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

June 1994

Geraghty & Miller is submitting this Work Plan for work to be performed at the Navistar International Transportation Company, Burlington Northern Railroad, and Iowa Interstate Railroad properties located in Rock Island, Illinois. This Work Plan was prepared in conformance with Geraghty & Miller's strict quality assurance/quality control procedures to verify that it meets industry standards in terms of the methods used and the information presented. If you have any questions or comments concerning this report, please contact one of the individuals listed below.

Respectfully submitted,

GERAGHTY & MILLER, INC.

James P. Auer
Project Engineer/Project Manager

Gregory A. Vanderlaan
Associate/Project Officer

CONTENTS

TABLES

FIGURES

APPENDICES

WORK PLAN
PHASE II SITE INVESTIGATION
NAVISTAR INTERNATIONAL TRANSPORTATION COMPANY/
BURLINGTON NORTHERN RAILROAD/
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

1.0 INTRODUCTION

This Phase II Site Investigation Work Plan (the Work Plan) has been prepared to describe the activities that will be conducted and the procedures that will be followed by Navistar International Transportation Corporation (Navistar), Burlington Northern Railroad (BNR), and Iowa Interstate Railroad (IIR) (the Respondents) to fulfill their obligations under the terms of the United States Environmental Protection Agency (USEPA) Administrative Order by Consent (the Order) for response actions associated with the Navistar, BNR, and IIR properties (the Navistar/BNR/IIR Site).

The Respondents have retained Geraghty & Miller, Inc. (Geraghty & Miller) to prepare the Work Plan and perform the activities described herein. Submittal of this Work Plan is intended to fulfill the Respondents' obligations for work to be performed under Task V.2 of the Order.

1.1 PURPOSE OF PHASE II SITE INVESTIGATION

The purpose of the Phase II Site Investigation is to collect and interpret additional hydrogeological data required to adequately define the nature and extent of petroleum hydrocarbon constituents on and in the groundwater and soil at the Navistar/BNR/IIR Site, as indicated in the Order. After completion of the Phase II site investigation appropriate removal action goals will be developed, based on the nature and extent of affected soil and groundwater as defined by the Phase II site investigation. Subsequent to the development of removal action goals, removal actions to address any imminent and substantial threat to the public health or

welfare, as a result of an actual or threatened discharge of oil from the site, will be implemented.

1.2 ORGANIZATION OF THE WORK PLAN

This Work Plan is organized into five sections of text, plus references, tables, figures, and appendices. A brief description of each section follows.

Section 1.0, Introduction, presents the purpose and organization of the Work Plan.

Section 2.0, Site Description, provides a summary of site conditions.

Section 3.0, Description of Phase II Site Investigation, describes the investigation activities that will be performed by Geraghty & Miller on behalf of the Respondents.

Section 4.0, Schedule, provides the schedule for the identified Phase II activities.

Section 5.0, Project Management, identifies the parties involved with implementation of the Phase II activities identified in Section 3.0.

Section 6.0, References, lists the reports that were cited or used in development of this Work Plan.

Appendix A, Sampling and Analysis Plan, describes the procedures that will be followed in the field during the collection of all Phase II environmental samples.

Appendix B, Quality Assurance Project Plan, describes the procedures that will be followed to document the quality of analytical data generated during the Phase II activities.

Appendix C, Health and Safety Plan, describes the procedures to be followed in the field to mitigate against potential physical or chemical hazards resulting from the Phase II field investigations.

1.3 TERMINOLOGY

Many acronyms and abbreviations are used throughout this Work Plan. A list of these terms is provided in Table 1.

2.0 SITE DESCRIPTION

This section of the Work Plan consists of a review of the physical setting, surrounding land use, and geological setting of the Navistar/BNR/IIR Site. The information presented in this section was obtained by Geraghty & Miller during the visual site inspection, conversations with Navistar and BNR representatives, previous site investigation reports, regulatory agency files, and from published information. A discussion of site history and previous site investigations is provided in the March 1994 Geraghty & Miller Report entitled "Initial Site Investigations, Navistar/Burlington Northern Railroad Properties, Rock Island, Illinois."

2.1 PHYSICAL SETTING

The former International Harvester Farmall (Farmall) manufacturing facility, now known as the Quad City Industrial Center (QCIC), is located adjacent to the Sylvan Slough. The Sylvan Slough is a tributary of the Mississippi River and flows between the site and Rock Island Arsenal, along 5th Avenue at 44th Street in Rock Island, Illinois (Figure 2-1). The former Farmall facility occupied approximately 80 acres, 20 of which are currently owned by Navistar; the remaining 60 acres, including the former facility buildings, are currently owned by the L.R. Christenson Company, the management firm operating the QCIC. The QCIC facility is approximately 1,250 feet (ft) wide and 8,250 ft long and occupies about 1.6 million square ft of floor space.

The Navistar portion of the former Farmall property extends immediately adjacent to the Sylvan Slough between the eastern property boundaries at 46th Street (the boundary between the Cities of Rock Island and Moline) and the western property boundary at about 28th Street. The first 5 ft of land immediately along the Sylvan Slough is owned by BNR. BNR also owns a parcel of property located immediately west of the QCIC property and south of the Navistar property. A layout of the current ownership of the former Farmall property and the location of the BNR property are depicted on Figure 2-2.

The general topography of the Navistar, BNR, IIR and QCIC properties is relatively flat, with a gentle westward slope, and with notable slopes between each separate parcel of land. Generally, the BNR and IIR properties are approximately 5 ft lower than the Navistar and QCIC properties. The northern edge of the Navistar property drops off approximately 20 ft to the Sylvan Slough, which is located immediately north of the Navistar, BNR, and QCIC properties. According to the elevation survey conducted by Beling Consultants, Inc. at each monitoring well location, the average ground elevations of monitoring wells at the Navistar, BNR, and QCIC properties are 567.3 ft above mean sea level (ft msl), 563.4 ft msl, and 569.0 ft msl.

2.2 SURROUNDING LAND USE

The Navistar/BNR/IIR site is located in an area of heavy industry along the Sylvan Slough. The nearest residential area is located south of 5th Avenue less than ¼ mile south of the Navistar/BNR/IIR site boundary; the campus for Augustana College is also located within this residential area. The surrounding land use is depicted on Figure 2-2.

As discussed previously, the Sylvan Slough forms the northern property boundary of the Navistar and QCIC properties; Rock Island Arsenal and Sylvan Island Park are on the opposite side of the slough.

The southern boundary of the Navistar, BNR, and QCIC properties primarily consists of a railroad rights-of-way with several tracks operated by IIR and one railroad right-of-way with two tracks operated by BNR. In addition to the right-of-ways, IIR also operates a large railyard service facility. The IIR service yard is located directly adjacent to the soil and groundwater study area. The IIR rights-of-way and service yard were formerly owned and operated by the Rock Island Railroad. Based on Geraghty & Miller's review of aerial photographs and Sanborn Fire Insurance maps, the Rock Island Railroad operated a roundhouse facility until the mid-1960s. The roundhouse facility was evident in a 1898 Sanborn map, but the exact date that the roundhouse facility began operations is unknown. In addition, existing aboveground oil storage

tanks on the IIR property were also evident on historical aerial photographs and Sanborn maps during the time that the Rock Island Railroad owned and operated the IIR property.

The property west of the Navistar property is primarily undeveloped; a river water pump station for the City of Rock Island is also reportedly located to the west (Pilko & Associates, Inc. 1987). The nearest property located east of the QCIC is the closed Midway Oil Company storage facility, which was a former distributor of Exxon products. Other properties located further to the east (along 3rd Avenue) include the City of Moline Wastewater Treatment Plant, an Iowa Illinois Electric Company Moline Generating Station, and a John Deere manufacturing facility.

2.3 GEOLOGICAL SETTING

The Navistar, BNR, and IIR properties are located on predominantly man-made fill and sand and gravel river deposits overlying either Pleistocene to recent-aged alluvium or Devonian-aged shale and limestone. The undeveloped western portion of the Navistar property has approximately 15 to 20 ft of fill in place. The fill material encountered at the site consists primarily of black sands and cinders that likely originated from the on-site foundry that was in operation until 1967 (Pilko & Associates, Inc. 1989). Below the fill material is a minimum of 10 ft of sands and gravels deposited by the Mississippi River. The sands and gravels overlie the limestone and shale. Prior to the placement of the fill material in the late 1950s to early 1960s, the undeveloped western portion of the Navistar property was often flooded by high waters from the Sylvan Slough, as shown in historical aerial photographs.

Based on available soil boring data, no fill material is present at the BNR property. The soils encountered at the BNR property consist strictly of alluvial (river) sand and gravel deposits, which overlie limestone or shale. The thickness of the unconsolidated sand and gravel river deposits, as determined by soil borings advanced on site, averaged approximately 15 ft across the BNR property.

The shale and limestone encountered at the Navistar and BNR sites belong to the Cedar Valley Formation of the Devonian Age. The Cedar Valley Formation is primarily a highly fossiliferous, crystalline, light gray limestone containing some fine-grained, argillaceous beds, thin shaley partings, and sandstone (Willman, et al. 1975). Near Rock Island, the Cedar Valley Limestone is about 60 ft thick and overlies the Wapsipinicon Limestone, which, in Illinois, is only exposed in the Rock Island area. The Wapsipinicon Limestone, also of Devonian Age, is dominantly fine-grained to lithographic, pure limestone with some argillaceous and dolomitic beds that have a maximum thickness of about 60 ft thick near the Mississippi River (Willman, et al. 1975). The Cedar Valley and Wapsipinicon Formations, along with the underlying Silurian Age dolomite and limestone, form the Hunton Limestone Megagroup.

3.0 PHASE II SITE INVESTIGATION SCOPE OF WORK

As indicated previously, the objective of the Phase II site investigation is to define the nature and extent of oil on and in the groundwater and soil at the Navistar/BNR/IIR Site. This information will then be used to develop appropriate removal action objectives for only affected soil and groundwater. As part of the Phase II site investigation, a number of field investigation and reporting activities will be conducted. Specifically, the Phase II site investigation will include the following six major tasks:

- Completion of subsurface borings.
- Installation of monitoring wells.
- Collection of soil samples for laboratory analysis.
- Collection of groundwater samples for laboratory analysis.
- Completion of an aerial survey for the site and location and elevation surveying of the existing and Phase II monitoring wells.
- Preparation of Phase II Site Investigation Report.
- Development of removal alternatives.

A description of the specific activities associated with the Phase II site investigation is provided in the following sections.

3.1 INSTALLATION OF SUBSURFACE BORINGS/MONITORING WELLS

As part of Phase II site investigation activities, a total of 12 continuously sampled bore holes will be drilled from the ground surface to estimated depths ranging from 20 to 25 ft below

land surface (bls). Each of the 12 soil borings will be completed as monitoring wells. These 12 monitoring wells are identified as Monitoring Wells GM-7 through GM-16 on Figure 3-1. Previous damage to existing Monitoring Well MW-10 (Figure 3-1) precludes the collection of groundwater samples from this well. New Monitoring Well GM-7 will therefore be used to replace the damaged well MW-10. Groundwater quality data from Monitoring Well GM-7 in conjunction with data from Monitoring Well GM-8 will be used to define the eastern extent of affected groundwater at the site, in conjunction with the results of previous soil and groundwater investigations. Monitoring Wells GM-9 through GM-15 will be used to evaluate groundwater quality associated with the IIR property. Monitoring Wells GM-16, GM-17 and GM-18 will be installed hydraulically upgradient from the IIR property, to evaluate background groundwater quality.

The 12 Phase II soil borings will be drilled using conventional hollow-stem auger (HSA) techniques. Two-inch diameter split-barrel samplers will be used to continuously sample the unconsolidated subsurface materials in each bore hole. This sampling will be conducted in accordance with American Society of Testing Materials (ASTM) Standard D1586-84. All split-barrel samples will be field-screened for hazardous constituents using a flame ionization detector (FID) or a photo ionization detector (PID).

Two split-barrel soil samples per soil boring will be submitted for chemical analysis of volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PNAs), and polychlorinated biphenyls (PCBs) as discussed in the Sampling and Analysis Plan (Appendix A). One of the two split-barrel soil samples will be collected from the interval immediately above the water table, and the other split-barrel soil sample will be collected based on the greatest evidence of subsurface contamination per soil boring using information obtained from the FID or PID screening. A groundwater sample will be obtained from each of the 12 new monitoring wells and 10 existing monitoring wells (MW-5, MW-6, MW-8, MW-9, GM-1, GM-2, GM-3, GM-4, GM-5, and GM-6) and subjected to chemical analyses (VOCs, PNAs, and PCBs) as discussed in the Sampling and Analysis Plan.

3.2 AERIAL SURVEYING AND LOCATION AND ELEVATION SURVEYING

All monitoring wells completed as part of the Phase II Site Investigation will be surveyed to provide horizontal and vertical data control. Elevations will be surveyed to the nearest 0.01 ft relative to mean sea level (msl). Horizontal locations for each of the monitoring wells will be determined to the nearest foot. In addition, an aerial survey of the site and site vicinity will be conducted to develop a local site topographic map.

3.3 PHASE II SITE INVESTIGATION REPORT

Subsequent to completion of Phase II Site Investigation activities, a Phase II Site Investigation Report will be prepared. This report will describe the equipment, methods, and techniques used to perform the Phase II site investigation work and will include the raw data generated, an interpretation of the data, and recommendations for additional investigative or removal activities, as appropriate. As indicated in the order, Geraghty & Miller, on behalf of the Respondents, will also submit monthly progress reports to the USEPA. These reports will describe all significant developments during the preceding period, including the work performed and any problems encountered, analytical data received during the reporting period, and developments anticipated during the next reporting period, including a schedule of work to be performed, anticipated problems, and planned resolutions of past or anticipated problems.

3.4 DEVELOPMENT OF REMEDIAL ALTERNATIVE

Based on the results of subsurface investigations conducted by previous investigators and the results of the Phase II investigation, Geraghty & Miller will conduct an engineering analysis of several potentially feasible source control alternatives for the Navistar/BNR/IIR Site. A brief description of Geraghty & Miller's technical approach for completing this task is presented in the following sections. An assessment of potentially available alternatives for the site, based on our preliminary review of the available site information is presented in Section 3.2.3.

3.4.1 Define Objectives of Removal Actions

At the conclusion of the additional data collection activities, the Geraghty & Miller project team will evaluate the information obtained in order to define the extent of contamination at the site. Where supported by additional data, estimates of the volume of free-phase liquid hydrocarbons, and the volume of affected soils will be made. At a minimum, the areal extent of affected media at the Navistar/BNR/IIR Site will be identified.

Removal action objectives will then be established for the site in consultation with the USEPA. Factors that will be considered during the development of the removal action objectives include: physical and chemical nature of contaminants of concern, possible migration routes, potential receptors, and any applicable regulatory requirements.

3.4.2 Identify Potentially Applicable Technologies

After development of the removal action objectives for the Navistar/BNR/IIR Site, Geraghty & Miller will prepare a preliminary list of potentially applicable technologies. The preliminary list of potential technologies will then be screened by Geraghty & Miller to develop a manageable set of options. The following factors will be considered in the screening process:

- Applicability of technology to site conditions.
- Effectiveness of technology for contaminants and media of concern.
- Ability to construct and operate the technology.
- Reliability of technology.

Only those technologies that have been commercially demonstrated and proven effective when used under similar site conditions will be retained for further evaluation at the Navistar/BNR/IIR Site.

3.4.3 Assemble Removal Action Alternatives

The potential technologies that are retained after the screening step will then be assembled into fully integrated alternatives that address recovery and/or treatment, discharge and management of treatment residuals. The list of assembled removal action alternatives will be reviewed with the Respondents and USEPA prior to the start of detailed evaluations.

3.4.4 Detailed Evaluation of Alternatives

The assembled alternatives will then be evaluated and compared to each other against the following criteria:

- Effectiveness.
- Implementability.
- Cost.

Effectiveness is measured by the degree to which the alternative achieves the objectives of the removal action. This will include the ability of the alternative to achieve the clean-up objectives established for the affected media.

The implementability criterion addresses the technical feasibility of constructing and operating the alternative. Significant site-specific construction problems will be considered, along with the time period for construction and start-up.

The capital and annual operation and maintenance (O&M) costs for each of the alternatives will be estimated. The estimate for capital costs will include both direct and indirect costs. Direct capital costs include the costs of all materials, equipment, and labor required to install the alternative. Indirect capital costs include the cost of engineering design, any legal fees, permitting, and start-up expenditures. Geraghty & Miller will prepare its cost estimates based on experience on similar projects, using a combination of published information, such as

Means Cost Estimating Guide, and unpublished data such as quotations from equipment vendors and service suppliers, and project notes.

The O&M costs cover post-installation activities required to operate the alternative, and include the costs for labor, parts, and other materials required to provide routine maintenance of equipment. Other O&M costs to be incurred include chemical and electricity needs for system operations, water and sewer service, and administrative costs.

3.5 PRELIMINARY ASSESSMENT OF POTENTIAL REMEDIAL ACTIONS

Based on a preliminary review of available site information, Geraghty & Miller has made an initial assessment of the type of removal action that may be appropriate at the Navistar/BNR/IIR Site. The discussion presented in this section is intended to provide the USEPA with an introduction to the types of technologies that will be considered in the alternatives evaluation, and the general guidelines for system selection. The assessments presented herein are preliminary in nature, and are subject to change based on the results of the additional data collection activities and the detailed alternatives evaluation.

3.5.1 Production Recovery System

Groundwater at the Navistar/BNR/IIR Site is believed to have been affected as a result of former site operations, notably a diesel fuel release from an aboveground storage tank. The results of previous groundwater sampling have revealed the presence of dissolved BETX (benzene, ethylbenzene, toluene, and xylene) and PNAs, along with a floating layer of hydrocarbons, or non-aqueous phase liquid (NAPL).

Active recovery of the NAPL would require an engineered system that includes each of the following elements:

- NAPL recovery.

- Separation/treatment.
- Treated effluent discharge.

As part of the alternatives evaluation conducted by Geraghty & Miller for the Navistar/BNR/IIR Site, potentially applicable NAPL recovery, treatment, and discharge technologies will be evaluated. A preliminary discussion of the technologies considered by Geraghty & Miller to be the most viable for the application at the Navistar/BNR/IIR site is presented in the following sections.

3.5.1.1 NAPL Recovery

The following discussion assumes that recovery wells, as opposed to some form of passive collection system (i.e., subsurface drain) will be utilized for NAPL recovery at the Navistar/BNR/IIR Site. Construction of a subsurface drain at this location does not appear to be practical due to the close proximity of the Sylvan Slough.

The following three recovery system technologies, at a minimum, will be considered in Geraghty & Miller's alternatives evaluation: (1) total fluid (NAPL and groundwater) removal using a single pump system, (2) separate NAPL and groundwater removal using a dual-pump system, and (3) total fluid vacuum enhanced recovery.

Based on the available site information, Geraghty & Miller does not anticipate at the present time that the use of skimming as a NAPL recovery method will be viable because of the relatively thin NAPL thickness reported at the Navistar/BNR/IIR Site. Also, since withdrawal rates are small, the hydraulic influence of an individual skimming well is limited. Skimming would also not provide effective hydraulic control over the entire effected area. However, this method will be evaluated based upon the results of additional data on NAPL thickness obtained during the additional data collection activities.

The alternatives evaluation will focus on several specific considerations relevant to the selection of an appropriate NAPL recovery system. The objectives of any NAPL recovery program would be to recover the product in a reasonable amount of time, and prevent the discharge of the non-dissolved liquid hydrocarbon to Sylvan Slough. In order to accomplish these objectives, the recovery rate must be adequate and the system drawdown or hydraulic influence must be sufficient to capture the entire areal extent of the NAPL.

Geraghty & Miller has proposed additional data collection activities for the Navistar/BNR/IIR Site to define the areal extent of the NAPL, its thickness (i.e., to estimate recoverable volume of product) and the hydraulic properties of the formation. With this information, the NAPL recovery system can be selected based on an optimized combination of individual well rates, and the number of wells and their locations. In general, it is cost effective to optimize individual well rates to accomplish the objectives with the minimum number of wells, resulting in the least complicated and most reliable system. The hydrocarbon recovery rate is generally proportional to the water production rate. Lower rates prolong recovery, result in a smaller individual well influence, but tend to produce better hydrocarbon/water ratios. Higher rates generally are more effective due to the greater individual well influence but tend to result in a lower hydrocarbon/water ratio requiring that water pumping rates be optimized to avoid unnecessary water production.

Another factor to be considered in the evaluation and selection of recovery systems is the water treatment and disposal requirements. The recovery of liquid hydrocarbon typically requires some degree of associated pumping of "co-produced" groundwater. The rate of NAPL recovery is, within certain limits, generally proportional to groundwater withdrawal rates. Water treatment and disposal capacity is therefore a major factor in recovery system evaluation. Systems to treat co-produced water typically include an oil/water separator, iron flocculation and filtration, and an air stripping unit and/or granulated activated carbon (GAC) filtration to reduce dissolved volatile hydrocarbon concentrations.

The quality of the co-produced water is generally a function of site groundwater quality, however, the type of recovery system and pumps selected can effect mixing and emulsification of co-produced water and hydrocarbon influencing both oil/water separation and dissolved hydrocarbon concentrations, both of which must be considered in system selection. A system that uses a separate water pump and a separate hydrocarbon pump tends to produce the best quality water, but is more complicated to operate and maintain. Additionally, these systems are only applicable where continuous water discharge rates from the wells(s) can be sustained. Geraghty & Miller will also evaluate systems which use auxiliary vacuum to enhance fluid flow at the Navistar/BNR/IIR Site.

3.5.1.2 Separation/Treatment

Geraghty & Miller will evaluate several commercially demonstrated technologies for treatment of co-produced water from the NAPL recovery system at the Navistar/BNR/IIR site. Systems to treat co-produced water typically include an oil/water separator, iron flocculation and filtration, and physical/chemical or biological treatment to reduce the dissolved fraction of the hydrocarbon compounds. The BETX and PNA compounds that have been detected in groundwater at the Navistar/BNR/IIR site can be treated with liquid-phase granular activated carbon (GAC) and biological treatment. Geraghty & Miller's alternatives evaluation, at a minimum, will assess the effectiveness of the following technologies for treatment of the co-produced water from the NAPL recovery system:

- Liquid-Phase GAC Absorbers; and,
- *Fixed-Film Biological Reactor.*

Information obtained during the additional data collection activities will be used to establish the system flow rate and expected groundwater influent water quality characteristics. Each of the water treatment technologies will be evaluated on its ability to achieve the required effluent limits for each of the discharged options considered.

3.5.1.3 Treated Effluent Discharge

The following options will be evaluated for discharge of the effluent from the water treatment system:

- Infiltration gallery;
- NPDES permitted discharge; and,
- Publicly Owned Treatment Works (POTW) discharge.

3.5.2 Vadose Zone Treatment

In addition to NAPL recovery, the alternatives evaluation will include an analysis of vadose zone treatment alternatives. Based on Geraghty & Miller's previous site investigation, a possible technology for treatment of the vadose zone at the Navistar/BNR/IIR Site appears to be some form of in-situ soil venting, either through a conventional soil vapor extraction (SVE) system or with an enhanced bio-venting system.

An SVE system operates by applying a metered vacuum on the zone of soil contamination through a gas extraction well. It is a treatment method that is particularly well-suited for the removal of BETX. Air flow is induced into the subsurface soil through ambient air inlet vents (e.g., well(s) and/or permeable soils located at the boundary of the contaminated zone). As air is drawn into the soil, it displaces soil gas which is in vapor-phase equilibrium with the BETX sorbed onto the soil particles and dissolved in the pore water. The soil gas is removed from the subsurface through the gas extraction well. The "clean" air in the soil matrix becomes recharged as a new vapor-phase equilibrium is re-established. As the process continues, the BETX sorbed onto the soil, and dissolved in pore water are gradually drawn off into the vapor phase. The BETX compounds are pulled from the gas extraction well and are released to the atmosphere or to emission control equipment dependent upon air emission requirements.

Bio-venting is designed to enhance naturally occurring biodegradation in the vadose zone by using forced air as the oxygen source. This method is effective in treating the less volatile fraction of hydrocarbon related contaminants, such as the PNAs. Depending on the air flow rates, BETX may be simultaneously removed from the contaminated soils. Bio-venting differs from conventional SVE in that the air flow induced into the vadose zone is optimized to reduce volatilization while still maintaining aerobic conditions for in-situ biodegradation. Moisture and nutrients can also be added as required to increase biodegradation. Bio-venting is well-suited for applications where a mixture of hydrocarbon-related compounds, with a fraction too heavy to volatilize, is present in the vadose zone.

4.0 SCHEDULE

Figure 4-1 presents the project schedule for the Phase II Site Investigation Activities that will be preformed by Geraghty & Miller on behalf of the Respondents for the Navistar/BNR/IIR Site.

5.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Figure 5-1 presents a project organization chart that shows management responsibilities of project personnel and lines of authority and communication. This hierarchy will be used to verify that all team members are familiar with their expected roles in completing a specific assignment. In addition, the hierarchy is designed to ensure that Geraghty & Miller meets the schedule required for project activities, and communicates satisfactorily with the Respondents. Table 5-1 contains the address and phone numbers of the Respondents, agency contacts and consultants associated with this project. The management responsibilities are described below:

USEPA OSC: Julie Zakutansky is the On-Scene Coordinator (OSC) for the site. Ms. Zakutansky has the overall responsibility for overseeing the implementation of the Order. The OSC shall have the authority vested in an OSC by the National Contingency Plan (NCP), including authority to halt, conduct, or direct any work required by the Order or any other response action undertaken by the Respondents or USEPA at the site.

Geraghty & Miller Project Manager: James Auer, the Geraghty & Miller Project Manager, will hold overall responsibility for technical and quality-related matters. Final decisions on recommendations, personnel assignments and the submission of final reports are made by the Project Manager. Although the actual preparation of written documents may be performed by other members of the project team, all of these documents will be subjected to Geraghty & Miller's rigorous QA/QC procedures and be reviewed and signed by the Project Manager and Project Officer. The Geraghty & Miller Project Manager is also the contact for the USEPA OSC.

Geraghty & Miller Project Officer: Gregory Vanderlaan, the Geraghty & Miller Project Officer, has overall responsibility for verifying that the project meets USEPA objectives and Geraghty & Miller's quality standards.

Geraghty & Miller Project Advisor: James Hill, the Geraghty & Miller Senior Project Advisor, has the responsibility to verify that the work is performed in accordance with established protocols.

Geraghty & Miller QA/QC Advisor: Tim Davis,the Geraghty & Miller QA/QC Advisor, has the responsibility to verify that the laboratory data are valid based on USEPA criteria and industry standards.

Geraghty & Miller Field Team Leader: The Geraghty & Miller Field Team Leader has the responsibility for leading and coordinating all of the activities undertaken during the Phase II Site Investigation. In addition, the Field Team Leader will be responsible for coordination and supervision of field staff. The Field Team Leader reports to the Geraghty & Miller Project Manager.

Geraghty & Miller Field Team: Geraghty & Miller will provide field staff for the project. The Field Team will collect samples, operate field equipment, and perform other field activities. The Field Team report to and work under the direction of the Geraghty & Miller Field Team Leader.

Geraghty & Miller Technical Staff: The technical staff used on this project will be drawn from Geraghty & Miller's pool of corporate resources. Technical staff will be utilized to gather and analyze data and to prepare various reports. Technical staff will include engineers, geologists, hydrogeologists, toxicologists and other specialists, as needed. The technical staff report to the Geraghty & Miller Project Manager.

6.0 REFERENCES

Pilko & Associates, Inc. 1987. Letter from R.J. Schuttler, Senior Associate with the Risk Management Division of Pilko & Associates, Inc. to R. Burad of Navistar International Corporation. Re: Environmental review of Farmall, Rock Island, Illinois, September 9, 1987.

Pilko & Associates, Inc. 1989. Soils and Groundwater Investigation for Farmall, Rock Island, Illinois, June, 1989.

Willman, H., Atherton E., Buschbach, T., et al. 1975. Handbook of Illinois Stratigraphy. Illinois State Geological Survey Bulletin 95, Urbana, Illinois.

TABLES

Table 1-1. Acronyms and Abbreviations, Navistar/BNR/IIR Site, Rock Island, Illionis.

ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Standards for Testing Materials
ATSDR	Agency for Toxic Substances and Disease Registry
CAA	Clean Air Act
CLP	Contract Laboratory Program
CRL	Central Regional Laboratory
CRP	Community Relations Plan
CWA	Clean Water Act
DQOs	Data Quality Objectives
EPTOX	Extraction Procedure Toxicity Characteristic
FID	Flame Ionization Detector
FS	Feasibility Study
G&M	Geraghty & Miller
HSP	Health & Safety Plan
IDL	Instrument Detection Limit
IRIS	Integrated Risk Information System
MCL	Maximum Contaminant Level (established under the SDWA)
MCLG	Maximum Contaminant Level Goal (established under the SDWA)
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAAQS	National Ambient Air Quality Standards
NCP	National Oil and Hazardous Substances Contingency Plan
NEPA	National Environmental Policy Act
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
PA	Preliminary Assessment
PID	Photoionization Detector
QA	Quality Assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Office
QAPjP	Quality Assurance Project Plan
QC	Quality Control
RA	Remedial Action
RAS	Routine Analytical Services
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan

Table 1-1. Acronyms and Abbreviations, Navistar/BNR/IIR Site, Rock Island, Illionis.

SAS	Special Analytical Services
SDWA	Safe Drinking Water Act
SOP	Standard Operating Procedures
SOW	Statement of Work
SWDA	Solid Waste Disposal Act
TCLP	Toxicity Characteristic Leaching Procedure
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound

CI0299.003\TBL1-1.WP5\jpa

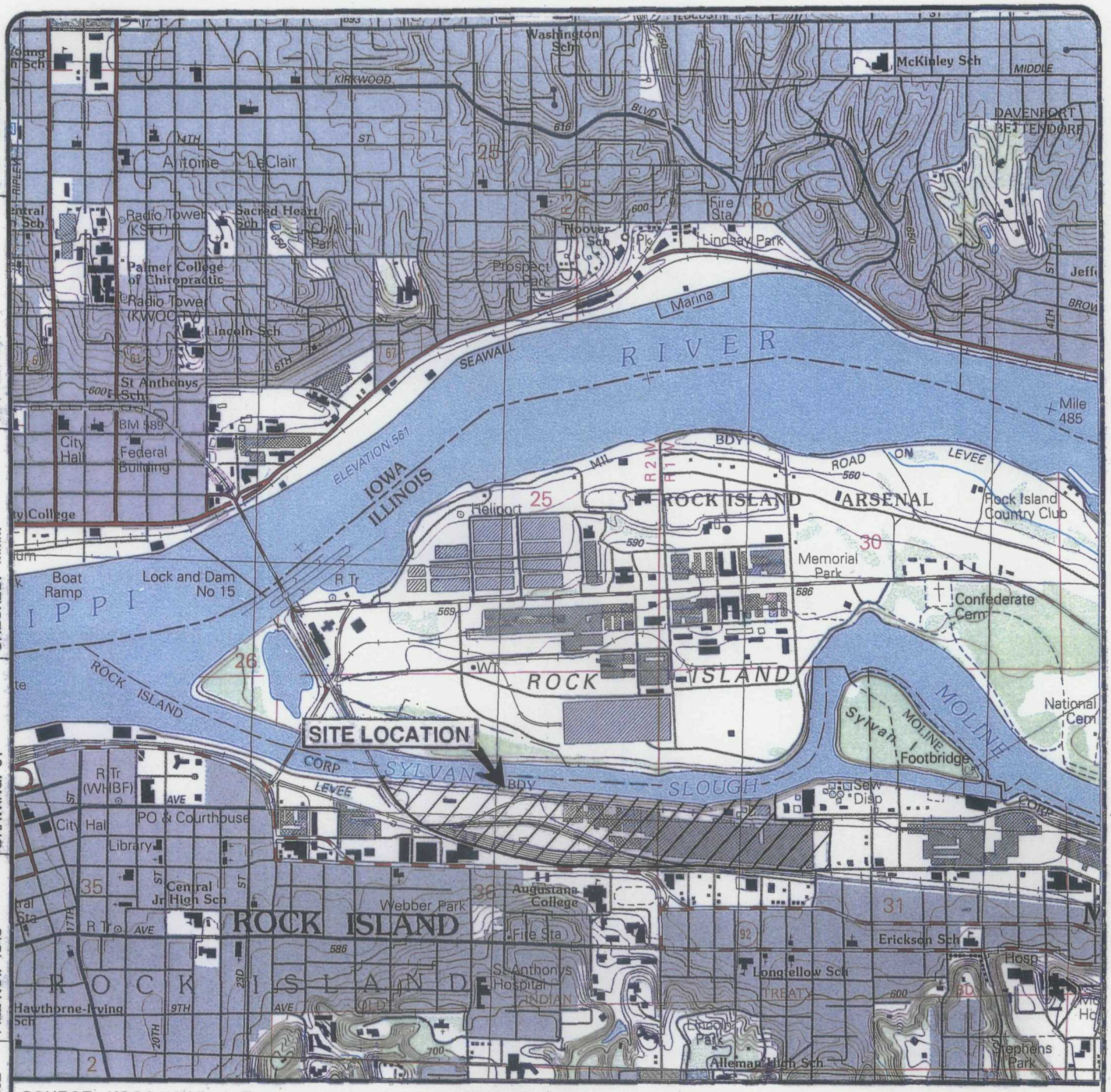
Table 5-1. Address and Phone List of Project Contacts.

Respondents	
Navistar International Transportation Corporation 455 North Cityfront Plaza Drive Chicago, Illinois 60601	Edith M. Ardiente (312) 836-3051
Burlington Northern Railroad 4105 North Lexington Avenue Arden Hills, Minnesota 55126	Greg Jeffries (612) 490-6105
Geraghty & Miller, Inc. 35 E. Wacker Drive Suite 1000 Chicago, Illinois 60601	Greg Vanderlaan (312) 263-6703
Regulatory Agency	
USEPA Region V 77 West Jackson Blvd. Mail Code HSE-5J Chicago, Illinois 60604	Julie Zakutansky (312) 886-5296
Analytical Laboratory Subcontractor	
Hertigate Laboratories, Inc. 1319 Marquette Drive Romesville, Illiinois 60441	Dawn Siekermann (708) 378-2169

CI0299.003\TBL5-1.WP5\jpa

FIGURES

DRAFTER: ELS
APPROVED:
CHECKED: MMM
DRAWING: 01
FILE NO.: 1343
PRJCT NO.: CI0299.002
DWG DATE: 01JUN94



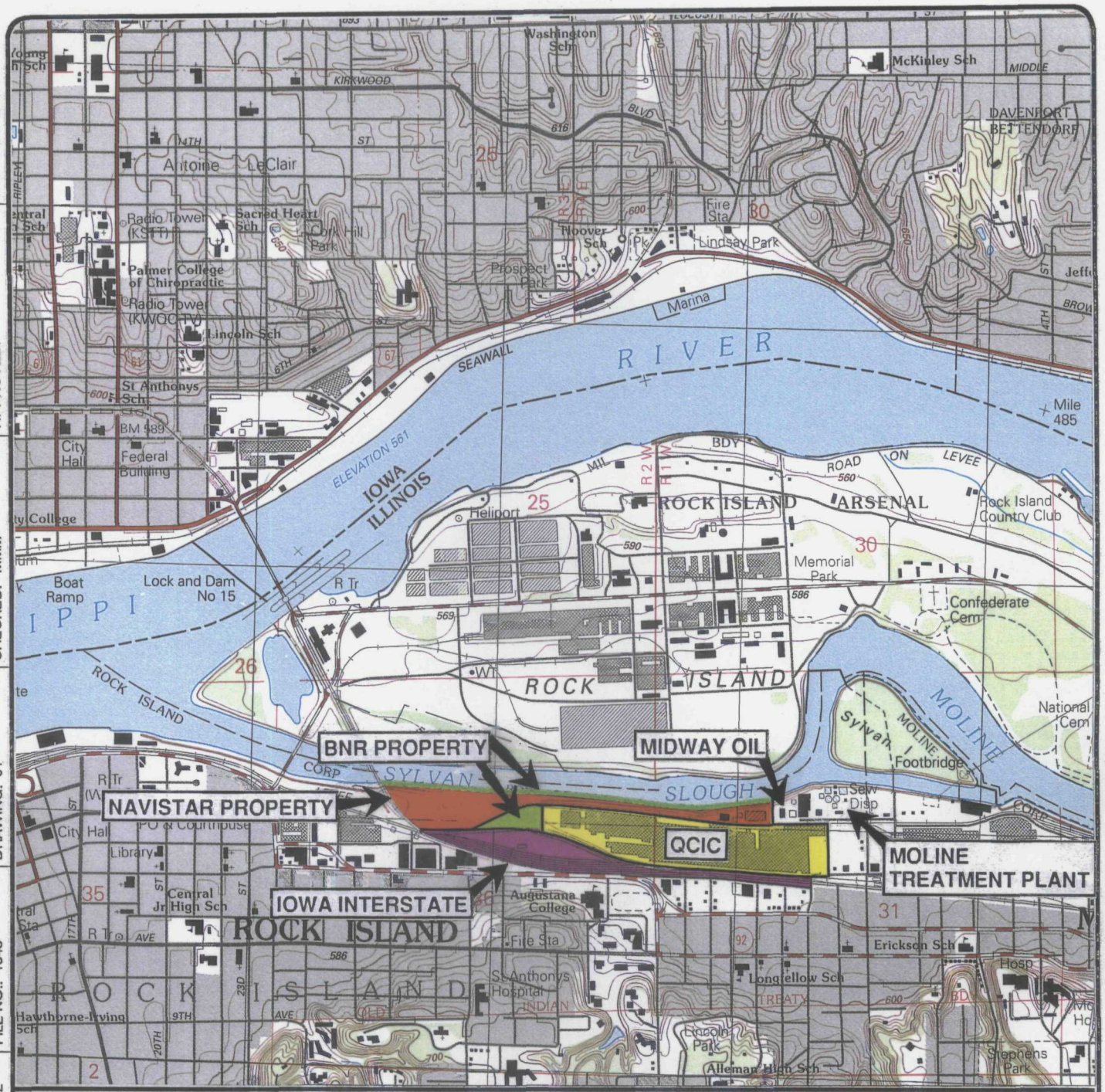
SOURCE: USGS 7.5 Minute Topographic Map, DAVENPORT EAST, IOWA-ILL. Quadrangle, 1991

GERAGHTY & MILLER, INC.
Environmental Services

SITE LOCATION MAP

PHASE II SITE INVESTIGATION WORK PLAN
NAVISTAR/BURLINGTON NORTHERN RAILROAD
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

FIGURE
2-1



GERAGHTY & MILLER, INC.
Environmental Services

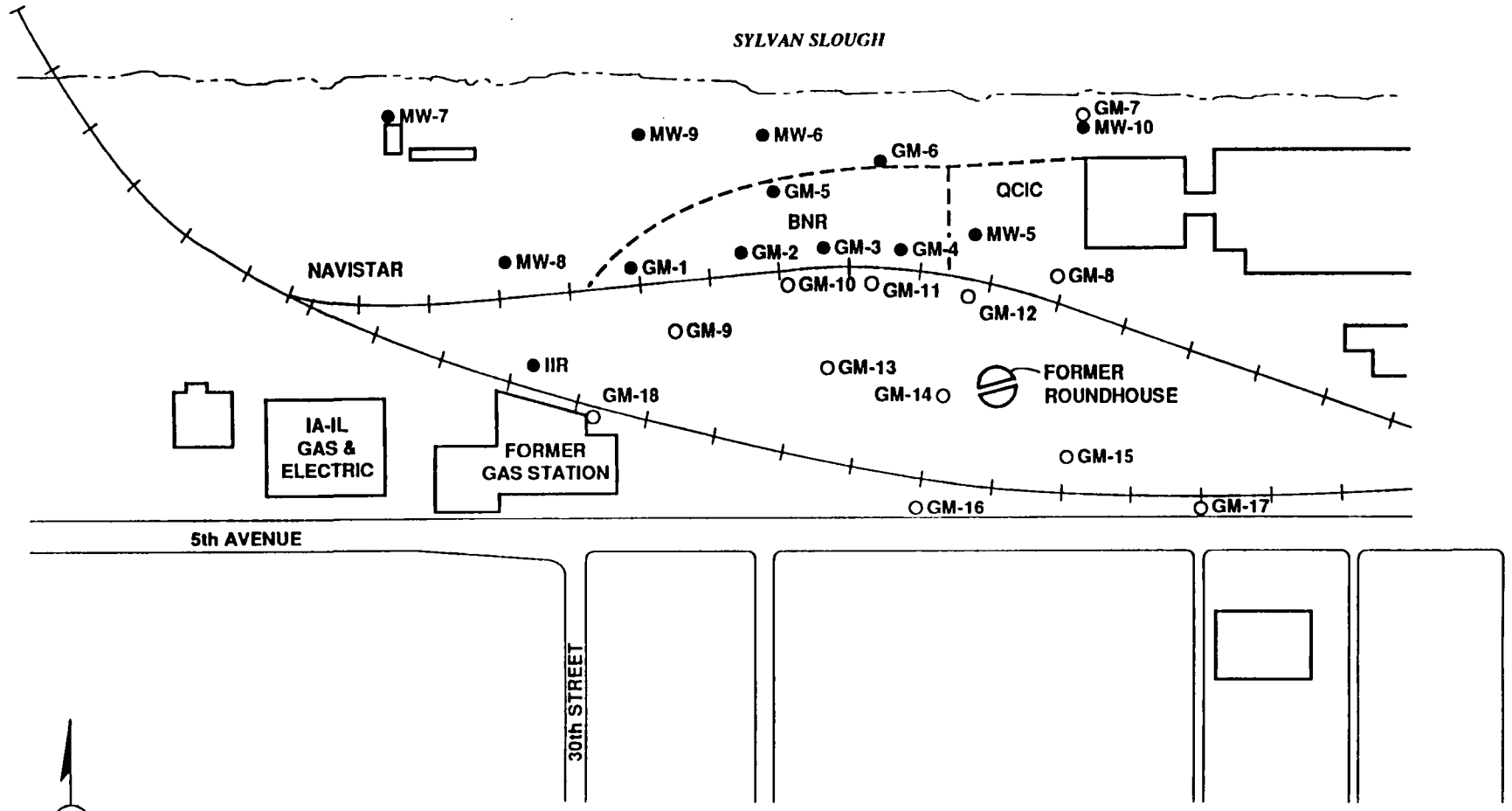
SITE LAYOUT/SURROUNDING LAND USE MAP

PHASE II SITE INVESTIGATION WORK PLAN
NAVISTAR/BURLINGTON NORTHERN RAILROAD
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

FIGURE
2-2

DRAFTER: ELS
APPROVED:
CHECKED: MMM
DRAWING: 01
FILE NO.: 1343
PRJCT NO.: CI0299.002
DWG DATE: 01JUN94

DWG DATE: 07JUN94	PRJCT NO.: CI0299.002	FILE NO.: 1343	DRAWING: 11	CHECKED: MMM	APPROVED:	DRAFTER ELS:



LEGEND

- ● GM-1 EXISTING MONITORING WELL
- ○ GM-13 PHASE II MONITORING WELL

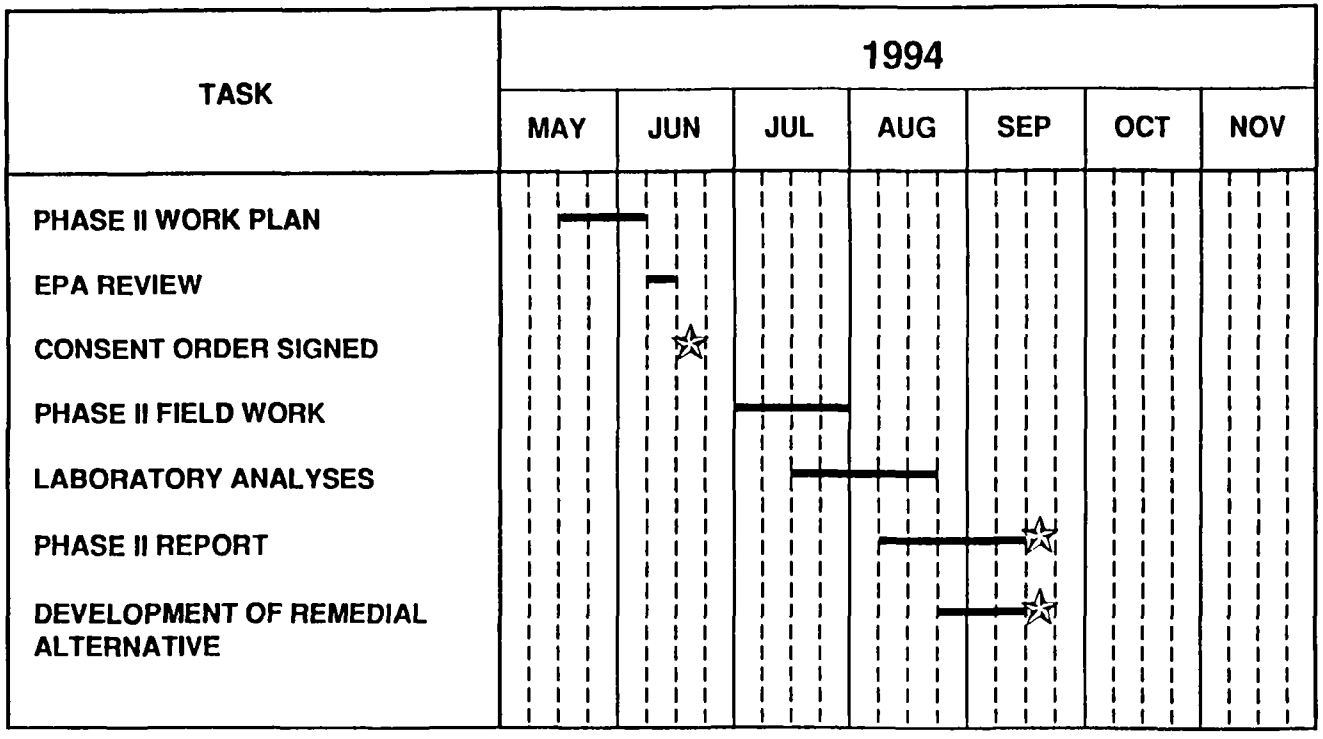
GERAGHTY & MILLER, INC.
Environmental Services

MONITORING WELL LOCATIONS

PHASE II SITE INVESTIGATION WORK PLAN
NAVISTAR/BURLINGTON NORTHERN RAILROAD
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

FIGURE
3-1

DWG DATE: 17JUN94	PRJCT NO.: CI0299.002	FILE NO.: 1340	DRAWING: 02	CHECKED: MMM	APPROVED:	DRAFTER: ELS



☆ PROJECT MILESTONE

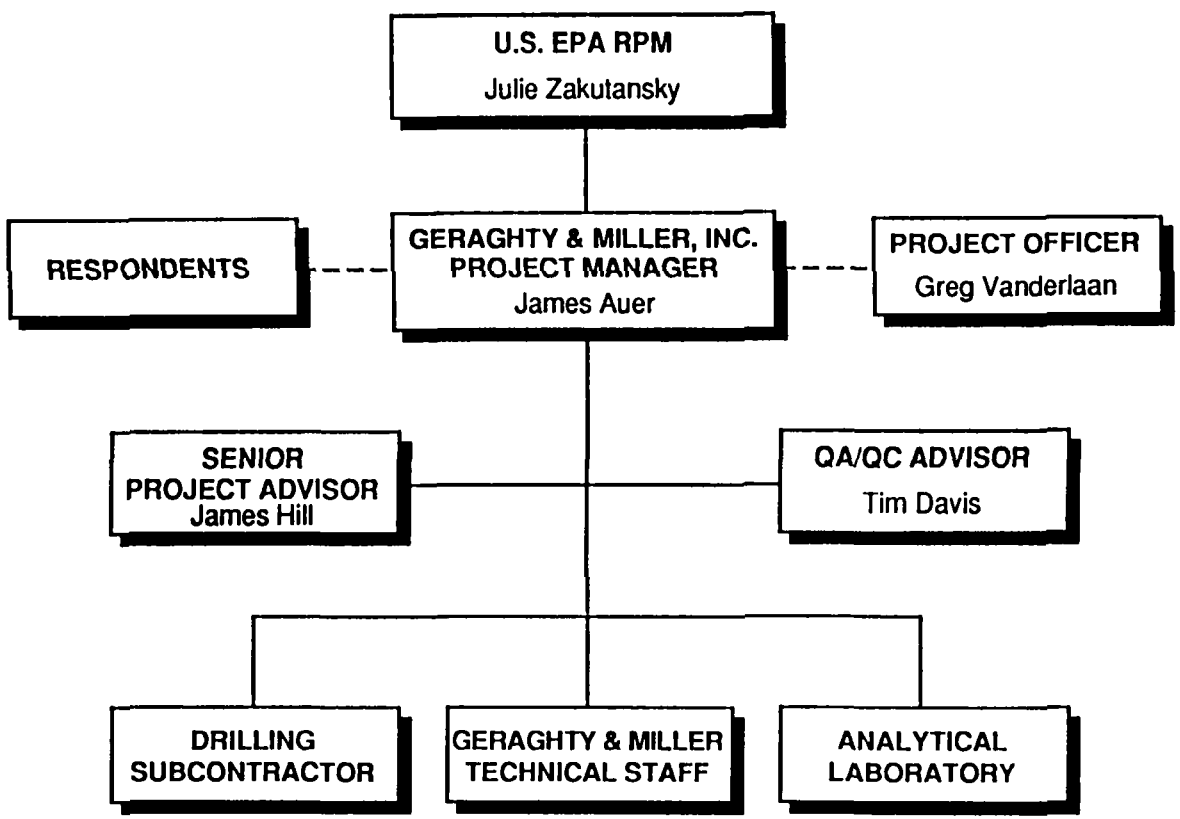
GERAGHTY & MILLER, INC.
Environmental Services

PROJECT TIMELINE

PHASE II SITE INVESTIGATION WORK PLAN
NAVISTAR/BURLINGTON NORTHERN RAILROAD
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

FIGURE
4-1

DWG DATE: 03JUN94	PRJCT NO.: CI0299.002	FILE NO.: 1340	DRAWING: 03	CHECKED: MMM	APPROVED:	DRAFTER: ELS



GERAGHTY & MILLER, INC.
Environmental Services

PROJECT TEAM ORGANIZATION

PHASE II SITE INVESTIGATION WORK PLAN
NAVISTAR/BURLINGTON NORTHERN RAILROAD
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

FIGURE
5-1

APPENDIX A

Sampling and Analysis Plan

SAMPLING AND ANALYSIS PLAN
PHASE II SITE INVESTIGATION
NAVISTAR INTERNATIONAL TRANSPORTATION COMPANY/
BURLINGTON NORTHERN RAILROAD/
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

June 1994

Prepared for

Navistar International Transportation Corporation
455 North Cityfront Plaza Drive
Chicago, Illinois 60601

and

Burlington Northern Railroad
4105 North Lexington Avenue, Suite 300
Arden Hills, Minnesota 55126-6181

Prepared by

Geraghty & Miller, Inc.
35 East Wacker Drive, Suite 1000
Chicago, Illinois 60601

CONTENTS

TABLES

FIGURES

ATTACHMENTS

SAMPLING AND ANALYSIS PLAN
PHASE II SITE INVESTIGATION
NAVISTAR INTERNATIONAL TRANSPORTATION COMPANY/
BURLINGTON NORTHERN RAILROAD/
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

1.0 INTRODUCTION

The purpose of this Phase II Site Investigation Sampling and Analysis Plan (SAP) is to present the quality assurance/quality control (QA/QC) measures employed during drilling and soil and groundwater sampling at the Navistar International Transportation Corporation (Navistar), Burlington Northern Railroad (BNR), and Iowa Interstate Railroad (IIR) properties (the Navistar/BNR/IIR site) in Rock Island, Illinois. Activities described within the SAP are proposed as part of the Phase II Site Investigation required by the U.S. Environmental Protection Agency (USEPA) as contained in the June 1994 Administrative Order by Consent (the Order) for the Navistar/BNR/IIR site. The following activities are planned:

- Completion subsurface borings.
- Installation of monitoring wells.
- Collection of soil samples for laboratory analysis.
- Collection of groundwater samples for laboratory analysis.
- Completion of an aerial survey for the site and location and elevation surveying of the existing Phase II monitoring wells.
- Collection of groundwater elevation measurements from new and existing site monitoring wells.

The SAP is derived from Geraghty & Miller field sampling protocols which are based on technically sound, standard practices such as those published in "Handbook for Sampling and Preservation of Water and Waste Water" (USEPA 1982); "CERCLA Groundwater Monitoring Technical Enforcement Guidance Document" (USEPA 1986); "Quality Assurance/Quality Control Guidance for Removal Activities" (USEPA 1990); and "Preparation of Soil Sampling Protocol, Techniques and Strategies" (Mason 1983). The protocols were developed to verify that Geraghty & Miller's field procedures are of uniform and high quality.

2.0 SAMPLE DESIGNATION

A sample designation system will be used to identify samples for chemical or physical analysis. A list of identifiers used for each sample will be maintained in the project log book by the Geraghty & Miller field team leader.

Each sample that is collected will be designated by a unique sample identification number. The first part of the identifier is a two-letter alpha code indicating the sample type. The sample-type alpha codes are as follows:

MW - Groundwater samples from existing site monitoring wells installed by Pilko & Associates, Inc.

GM - Groundwater or soil sample from existing and/or Phase II monitoring wells installed by Geraghty & Miller.

The sample type is followed by a two-digit numerical code, which indicates the sample number. For soil samples, the two-digit numerical code will be followed by a four-digit numerical code that indicates the depth of the soil sampling interval. For example, GM10-0810 indicates a soil sample collected at a depth of 8 to 10 feet below land surface (ft bls) from Monitoring Well GM-10.

Quality assurance samples consist of trip blanks, equipment blanks, field duplicates, and matrix spike/matrix spike duplicates and will be designated by an identifier. Additional information concerning quality assurance samples is presented in the Quality Assurance Project Plan (Appendix B).

Trip blanks will be labeled with the two-part identifier, except that two-digit numeric code will correspond to the cooler number, rather than the sample number, and "TB" will be used as the sample type alpha code. Trip blanks are only analyzed for volatile organic compounds (VOCs).

Equipment blanks will be labeled with a two-part identifier, and "EB" will be used as the sample type code. Each equipment blank will be assigned a unique sample number. The Geraghty & Miller Field Team Leader will indicate in the log book, the sampling equipment corresponding to each equipment blank.

Field duplicates will be identified with a unique sample identification number, such that the laboratory will not be aware that the sample is a duplicate. The Geraghty & Miller Field Team Leader will note in the log book the duplicate samples, so this information will be available when the laboratory data is validated.

Matrix spike/matrix spike duplicate (MS/MSD) samples are not separate samples; therefore, they are not assigned unique sample numbers, as are the field duplicates, equipment blanks, and trip blanks. The only difference between a MS/MSD sample and a standard sample is that additional sample volume is collected at the location that the MS/MSD sample is obtained. These samples will be identified by adding "MSD" to the identifier of the sample where the MS/MSD sample is collected.

3.0 FIELD PROCEDURES

This section discusses the field methodologies and sampling procedures to be employed by Geraghty & Miller during the Phase II Site Investigation.

3.1 SUBSURFACE BORINGS

The Phase II Site Investigation soil borings (Figure A3-1) will be installed using the conventional hollow-stem auger (HSA) technique. The screened interval of the wells will be selected such that the screen of each well intersects the water table, as estimated from field observations. Seasonal fluctuations of the water table will also be considered in the placement of the well screen. The borings will be drilled using 4¼-inch inner diameter (I.D.) hollow-stem augers and the subsurface soils will be continuously sampled using 2-inch diameter split-barrel samplers. Prior to drilling at each location, the driller's borehole equipment will be steam-cleaned to reduce the potential for cross-contamination of the borehole.

Split-barrel soil samples will be screened with a flameionization detector (FID) or photoionization detector (PID) to determine if VOCs are present. The soil samples will be described by the field geologist and a description will include estimated grain size and grain size distribution, approximate degree of sorting, color, apparent moisture, odor and other characteristics as appropriate. A drilling log will be kept by the field geologist that will include sample descriptions, FID or PID readings, depth to water and hammer blow count, as shown in Attachment A-1. The split-barrel soil sampling will be conducted in accordance with American Society of Testing Materials (ASTM) standard D1586-84. Each 2-ft long split-barrel sample will be classified in the field in accordance with ASTM standard D2488-90. If elevated levels of organic vapors are detected with the FID or PID during sample logging, the procedures outlined in the Health and Safety Plan (Appendix C) will be followed to determine the appropriate level of personnel protection.

When the appropriate depth has been reached as determined by the field geologist, each monitoring well will be constructed inside of the hollow-stem augers; when the well construction

has been completed the augers will be removed from the boring. Each well will be constructed of 2-inch I.D., Schedule 40 polyvinyl chloride (PVC) casing and a 10-ft stainless steel screen with 0.010-inch slot size. The PVC will meet ASTM D1785 specifications. The screen will be placed such that the water table is approximately 3 ft below the top of the screen; a well construction detail is provided in Attachment A-2.

Following placement of the well casing and screen in the borehole, a filter pack of clean, graded silica sand will be placed in the annular space between the well and the borehole to a level at least 2 ft above the top of the well screen. Above the filter pack, bentonite pellets or granular bentonite slurry will be placed as an annular space seal with a minimum thickness of 2 ft. A bentonite/cement grout mixture consisting of 5 percent bentonite and 95 percent cement will be placed from the top of the bentonite seal to a depth approximately 1 ft below the frost zone. At the surface, a concrete cap that extends below the frost zone and slopes away from the well casing will be installed. A protective steel casing with a locking cap designed to protect the portion of the well casing above the ground surface will be set just prior to pouring the concrete cap.

The depth of the borehole bottom, bottom of screen, top of filter pack, top of filter pack seal, and top of annular space seal will be measured and recorded. The volumes of both sand and bentonite slurry required will be calculated, measured, and recorded. The borehole and well casing diameters, as well as the height of the well casing (without cap/plug) will also be measured and recorded.

Each monitoring well will be developed no sooner than 12 hours after well completion. The well will be surged and purged using a surge block or bailer for a minimum of 30 minutes. A minimum of 10 well volumes will then be removed, and the water produced during development will be contained and disposed of as described in the Disposal of Investigation-Derived Materials section of the SAP (Section 3.4). Development will continue until the well produces clear, sediment-free water to the extent possible. In addition, pH and specific conductivity measurements will be obtained from water samples collected during well

development. Well development will continue until pH and specific conductivity values have stabilized. For each well, a 1-pint sample of the last water to be removed during development will be obtained and inspected by the field geologist for relative clarity to determine whether development is complete. Dispersing agents, acids, disinfectants, or other additives will not be used during development, nor will they be introduced into the well at any other time. The following data will be recorded as part of well development:

- The static water level measured from the top of the well casing before and after development is completed.
- The calculated quantity of fluid standing in the well prior to development.
- The sounded well depth before and after development to determine if siltation has occurred inside the well.
- The physical character of water removed including changes in clarity, color, particulate, and odor that occur during development.
- Specific conductivity and pH values.
- The development technique used.

The drill rig, augers, rods, screens, casing, and other equipment that are used to construct the wells will be decontaminated before operations begin at each well location. The equipment will also be decontaminated before the equipment is allowed to leave the site. The decontamination will be conducted using steam cleaners with laboratory-grade detergent and water from a known uncontaminated source.

The well locations and elevations will be surveyed by a registered land surveyor. The horizontal location will be surveyed to the nearest 1 ft, and the elevations to the nearest 0.01 ft.

The monitoring wells will also be located on the site-specific topographic map that will be developed from the aerial survey performed during the Phase II site investigation.

3.2 CONSTRUCTION OF DECONTAMINATION PAD

A lined decontamination pad will be constructed to collect all potentially contaminated water generated during the decontamination of drill rig, augers, rods, screens, casing, and other equipment used to construct the wells. The decontamination will be conducted using steam cleaners with laboratory-grade detergent and water from a known uncontaminated source. The decontamination pad will be graded to a sump that will temporarily contain the decontaminated water prior to transfer of the water to appropriate storage containers (i.e., 55-gallon drums) or disposal location. The exact location of the decontamination pad will be determined in the field, in consultation with the USEPA.

3.3 DISPOSAL OF INVESTIGATION-DERIVED MATERIALS

During the course of the monitoring well installation and other field activities, the following investigative-derived materials will be generated:

- Disposable personal protective clothing.
- Drill cuttings.
- Water used for decontamination of split-barrel samplers and other equipment at the drilling site.
- Water used for steam cleaning at the decontamination pad.
- Water collected during well development and groundwater sampling.

Personnel protective clothing will be collected in 55-gallon drums and stored on-site until proper disposal procedures are determined. These items will be placed in plastic trash bags after use so that they are contained while being transported to the designated 55-gallon drums.

Fluids generated during drilling, well installation and development, and well purging will be stored in temporary aboveground tanks or 55-gallon drums until laboratory results of the fluids demonstrate that the fluid can be discharged to the ground. In the event that the fluids have been affected, the fluids will be appropriately treated and disposed. Similarly, soil cuttings generated during drilling will placed on and covered with plastic sheeting near each borehole until soil quality results demonstrate that the soil cuttings can be deposited to the ground. In the event that the soil cuttings have been affected, the soil cuttings will be appropriately treated and disposed.

3.4 SOIL SAMPLING AND LABORATORY ANALYSES

A total of two spilt-barrel soil samples will be retained for laboratory analysis from each of the 12 Phase II monitoring installation borings, for a total of 24 soil samples. The 24 Phase II soil samples will be subjected to laboratory analyses for the following parameters: VOCs, polynuclear aromatic hydrocarbons (PNAs), and polychlorinated biphenyls (PCBs). Upon request, the Respondents will allow the USEPA the opportunity to collect split samples. A summary of the soil sampling and analysis program for the Phase II site investigation is provided in Table A3-1.

The following general procedures will be employed for subsurface soil sampling.

1. The borehole number will be recorded in the field book and on the boring log.

2. All necessary sample containers will be prepared and labeled.

3. Each borehole will be drilled using standard hollow-steam auger techniques; split-spoon samples will be collected continuously over each 2-foot interval.

4. Drilling will proceed to the start of the sampling depth (bottom depth of the last split-spoon sample) in each boring, a soil sample will then be obtained by driving a split-spoon sampler. The number of blow counts required to drive the split-spoon over each 6-inch interval will be recorded on the boring log.

5. As the split-spoon sampler is recovered from the borehole it will be opened and the soil sample will be immediately screened for the presence of VOCs using an FID or PID.

6. If volatile organic laboratory analysis is to be performed on a selected soil sample from a boring, the container designated for volatile analysis will be filled immediately after screening to minimize volatilization. The other sample containers may then be filled. All samples subject to laboratory analyses will be placed on ice in the cooler. A summary of soil sample containers is provided in Table A3-2.

7. The lithology of the sample will then be described on the sample/core log. The description will include the major and minor components, color, consistency or density, relative moisture content, and any other observations.

8. All sampling equipment will be decontaminated using a laboratory grade detergent followed by a distilled water rinse. A sufficient number of split-spoons will be kept in the field to achieve uninterrupted sampling. The

drilling equipment and hollow-stem augers will be decontaminated by steam cleaning prior to beginning each boring.

9. All soil cuttings will be containerized, covered and clearly marked pending laboratory analyses.

Equipment for the soil borings and subsurface soil sampling will include the following:

- Clean, new sample containers.
- Hollow-stem auger drilling equipment with split-spoon sampling capabilities.
- Two-foot split-spoon (2-foot sample recovery).
- Personnel safety equipment including a PID or FID.
- Coolers with ice.
- Distilled water, laboratory grade detergent, wash tubs, and a steam cleaner.
- Stainless steel trowel and/or spoon.

3.5 GROUNDWATER SAMPLING AND LABORATORY ANALYSES

The following protocol has been developed to obtain samples that provide representative groundwater quality information. It is intended for use in sampling monitoring wells during the Phase II site investigation. Groundwater samples will be collected from the 12 Phase II monitoring wells and 10 existing monitoring wells, for a total of 22 groundwater samples. The

groundwater samples will be submitted for laboratory analysis for the following parameters: VOCs, PNAs, and PCBs. Upon request, the Respondents will allow the USEPA the opportunity to collect split samples. A summary of the groundwater sampling program is provided in Table A3-1.

Well evacuation procedures are as follows:

1. The well will be identified and its designation will be recorded on a water sampling data sheet.

2. The top of the well will be cleaned with a clean rag to prevent loose particulate matter from falling into the well.

3. The steel measuring tape or water-level probe will be decontaminated with a laboratory-grade solution wash and triple-rinsed with distilled water and the depth to groundwater will be measured.

4. The volume of water in the monitoring well will be computed.

5. Three-to-five times the volume of standing water in the well will be removed using a dedicated bailer or pump, as appropriate.

The monitoring well sampling procedures are as follows:

1. The groundwater samples will be collected using bottom-filling dedicated bailers. The bailer will be lowered into the well in a manner which minimizes disturbances to the water table. The bailer will be removed carefully and the water sample gently poured into the sample containers such that the volatilization of organic compounds is minimized. The bailer cord will be replaced between successive monitoring well locations.

The same cord may be used for successively collected duplicates. Precautions will be taken such that the bailer cord will not touch the ground, the protective well casing, or the skin/protective clothing of the sampler. In addition, the sampler will avoid application of insect repellent, perfume, cologne, sunscreen and/or moisturizer prior to sampling monitoring wells, in order to avoid contaminating the monitoring wells with these items.

2. Once samples have been collected they will be prepared and preserved in accordance with recommended USEPA procedures. Preparation and preservation procedures are outlined in Table A3-2. The sample jars will be provided by the project laboratory. The empty jars will contain the appropriate chemical preservative. The laboratory will also pre-label the jars indicating the specific preservative used.

3. Temperature, pH, and specific conductance of the groundwater sample will be measured in the field.

4. All measurement instruments contacting the groundwater sample will be decontaminated with a laboratory-grade solution wash and triple-rinsed with distilled water.

The following field equipment is required for well evacuation and sampling:

- Appropriate health and safety equipment.
- Chain-of-custody forms and other appropriate forms.
- Labels.
- Logbook, marking pens, federal express airbills and pouches.
- Clean 55-gallon drum.
- Clean rags.

- Conductivity meter and conductivity bridge.
- pH meter, electrode, standard buffer solutions.
- FID/PID.
- Thermometer.
- Disposable gloves.
- Disposable polyethylene bailer cord.
- Distilled or deionized water.
- Water level indicator graduated in 0.01 ft increments.
- Ice.
- Laboratory-grade detergent, laboratory brush, bucket, wash tub.
- Rubber gloves.
- Sample containers, cooler and packaging material provided by laboratory.
- Bailers.
- Tools and/or keys required for opening wells.
- Tools for opening drums.
- Camera and film.

4.0 DOCUMENTATION

A field logbook will be used to record all daily activities performed at the site. Entries will be written in sufficient detail such that a particular situation can be reconstructed. This field logbook will be a bound, field survey book. Logbooks will be assigned to field personnel, but will be stored securely in the office when not in use. After project completion, the Geraghty & Miller Project Manager will maintain custody of these documents.

Entries into the logbook will contain a variety of information including the data, start time, weather, all field personnel present, level of personnel protection being used on-site, and the signature of the person making the entry. The names of visitors to the site, all field sampling team personnel, and the purpose of their visit will be recorded in the field logbook.

Geraghty & Miller sample/core logs will be used to describe the lithology. Whenever a sample is collected or a measurement is made, a detailed description of sampling location and matrix will be recorded in the field logbook. All equipment used to make measurements will be identified. All sample collection procedures will be documented on appropriate forms or in the logbook.

When a photograph is taken, a notation will be made in the logbook indicating the date, roll number, photo number, time, direction that the camera is facing, and location. All photographs taken during the Phase II Site Investigation will be reviewed after processing. The negative numbers will be compared to the photo numbers indicated in the logbook and on the photo identifier in the picture. A log of photographs taken during the Phase II Site Investigation will be compiled and included in the Phase II Site Investigation report. This log will indicate both the photo number assigned in the field and the negative number, in order to avoid confusion associated with future references to photographs. Any missing, indistinguishable or poor quality photographs will also be noted in the photo log.

TABLES

Table A3-2. Sample Containers, Preservatives, and Holding Times.

Sample Type	Laboratory Parameters [1]	Required Quantity	Number of Containers	Container Type	Preservatives [2, 3]	Holding Time [4]
Soil	VOCs	25 grams	1	4-ounce glass jar	--	14 days
	PNAs	150 grams	1	8-ounce glass jar	--	14 days until extraction; analysis within 40 days
	PCBs	150 grams	1	8-ounce glass jar	--	14 days until extraction; analysis within 40 days
Groundwater	VOCs	80 ml	2	40 ml glass vials	HCl to pH <2[5]	14 days
	PNAs	2 liters	2	1 liter amber glass bottle	--	7 days until extraction; analysis within 40 days
	PCBs	1 liters	1	1 liter amber glass bottle	--	7 days until extraction; analysis within 40 days

1 All water samples are unfiltered.

2 Samples will be shipped to project laboratory via overnight carrier.

3 All samples will be cooled to 4°C immediately after collection and maintained at this temperature during shipment to the project laboratory.

4 Holding times begin on the date the sample is collected.

5 Sample containers will be full and free of headspace.

6 One trip blank will be included in each cooler that contains aqueous VOCs samples. If possible, all aqueous VOCs samples will be shipped to the laboratory on the same day, such that only one trip blank per day would be required.

Table A3-1. Summary of Sampling and Analysis Program..

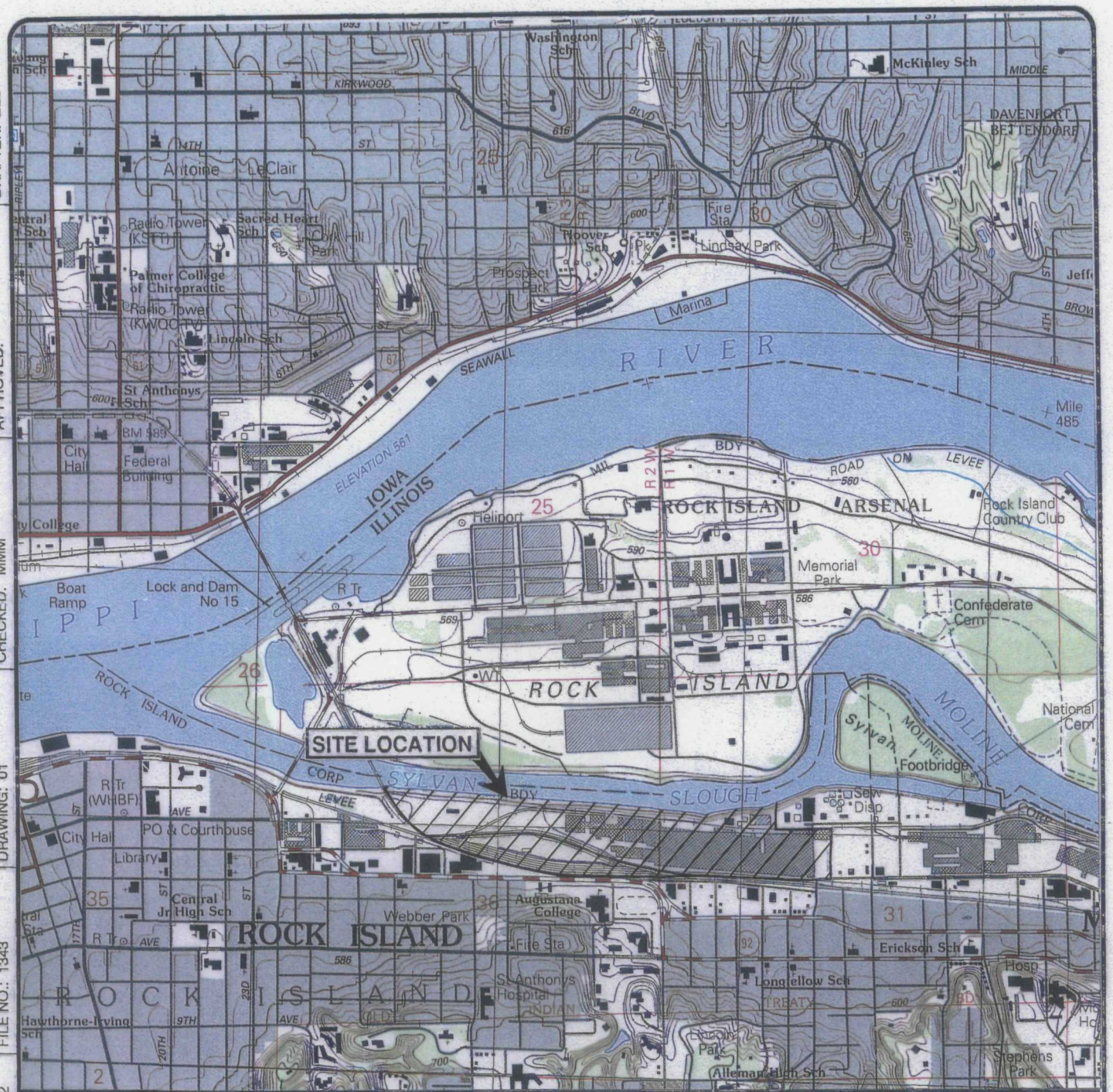
Sample Type	Field Measurements and Observations	Laboratory Parameters [2]	Analytical Method	DQO Analytical Level	# of Samples	QUALITY CONTROL SAMPLES # of Field Duplicates	# of Equipment Blanks	# of MS/MSD	Total # of Samples
Soil	- Organic vapor screening using PID or FID [1]	VOCs	8240	IV	24	0	0	2	26
		PNAs	8310	IV	24	0	0	2	26
		PCBs	8080	IV	24	0	0	2	26
Groundwater	- pH	VOCs	8240	IV	22	3	5	2	32
	- Specific Conductance	PNAs	8310	IV	22	3	3	2	30
	- Temperature	PCBs	8080	IV	22	3	3	2	30
	- Qualitative observation of color and turbidity								

1 PID/FID screening will provide qualitative information regarding the concentration of VOCs in the sample and provide information for health and safety purposes.

2 All water samples are unfiltered; VOCs = Volatile Organic Compounds; PNAs = polynuclear aromatic hydrocarbons; PCBs = polychlorinated biphenyls.

CI0299.003\TBL-A3-1.XLS

FIGURES



DRAFTER: ELS
APPROVED:
CHECKED: MMM
DRAWING: 01
FILE NO.: 1343
PRJCT NO.: C10299.002
DWG DATE: 01JUN94

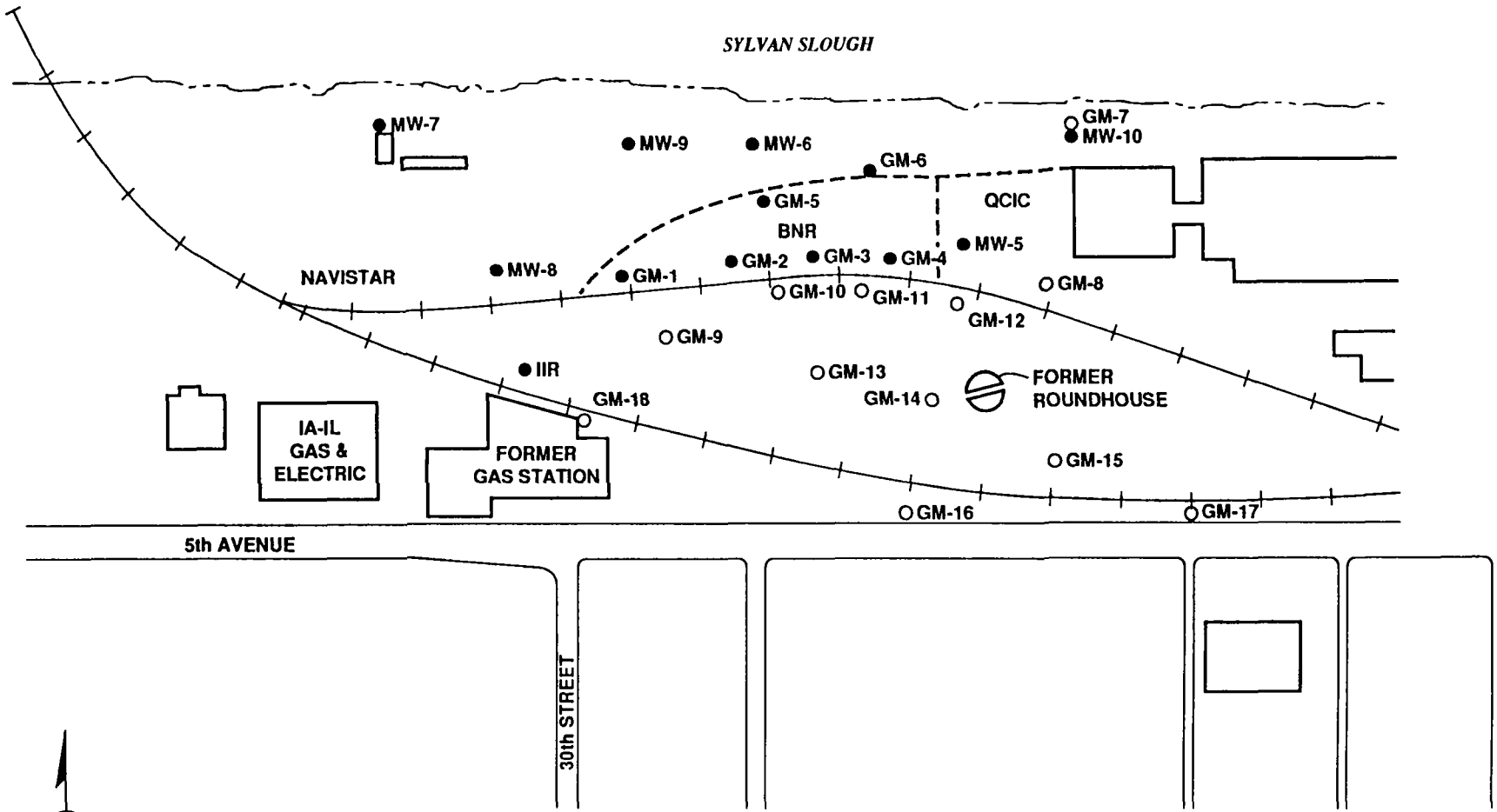
GERAGHTY & MILLER, INC.
Environmental Services

SITE LOCATION MAP

PHASE II SITE INVESTIGATION WORK PLAN
NAVISTAR/BURLINGTON NORTHERN RAILROAD
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

FIGURE
A1-1

DWG DATE: 07JUN94	PRJCT NO.: CI0299.002	FILE NO.: 1343	DRAWING: 08	CHECKED: MMM	APPROVED:	DRAFTER ELS:



LEGEND

- ● GM-1 EXISTING MONITORING WELL
- ○ GM-13 PHASE II MONITORING WELL

GERAGHTY & MILLER, INC.
Environmental Services

MONITORING WELL LOCATIONS

PHASE II SITE INVESTIGATION WORK PLAN
NAVISTAR/BURLINGTON NORTHERN RAILROAD
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

FIGURE
A3-1

ATTACHMENT A-1

SAMPLE/CORE LOG

GERAGHTY & MILLER, INC.
Ground-Water Consultants

SAMPLE/CORE LOG

Boring/Well _____ Project/No. _____ Page _____ of _____

Site Location _____ Drilling Started _____ Drilling Completed _____

Total Depth Drilled _____ (feet)

Hole Diameter _____ (inches) Type of Sample/ Coring Device _____ _____

Length and Diameter of Coring Device _____ Sampling Interval _____ feet

Drilling Fluid Used _____ Drilling Method _____

Drilling Contractor _____ Driller _____ Helper _____

Prepared By _____ Hammer Weight _____ Hammer Drop _____ inches

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description

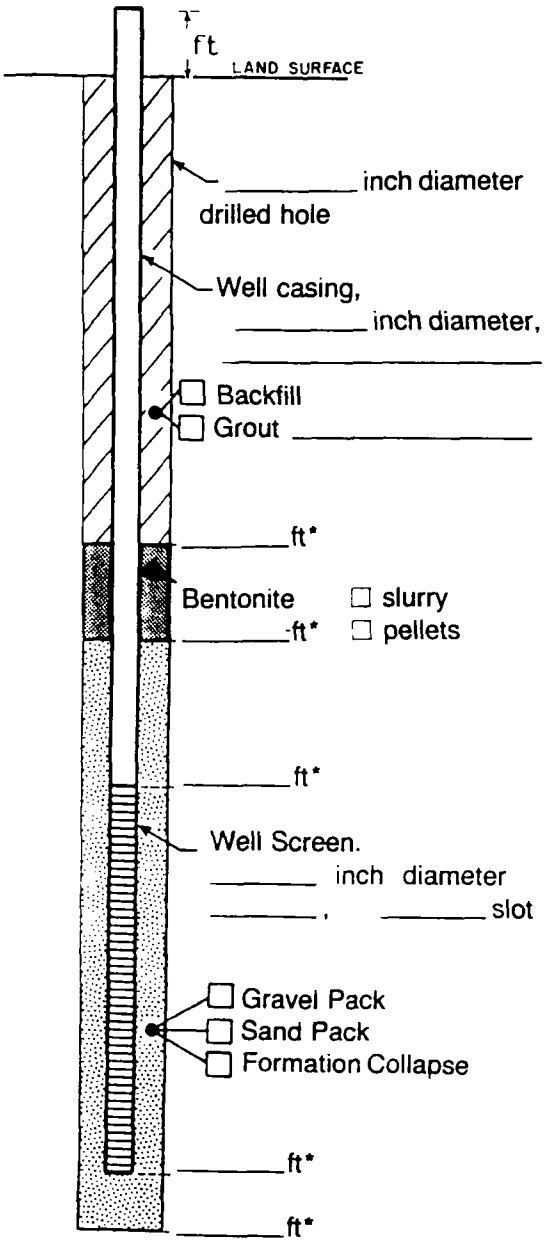
ATTACHMENT A-2

WELL CONSTRUCTION DIAGRAMS

GERAGHTY & MILLER, INC.
Ground-Water Services

WELL CONSTRUCTION LOG

(UNCONSOLIDATED)



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.

*Depth Below Land Surface

Project _____ Well _____

Town/City _____

County _____ State _____

Permit No. _____

Land-Surface Elevation

and Datum _____ feet ☐ Surveyed

_____ ☐ Estimated

Installation Date(s) _____

Drilling Method _____

Drilling Contractor _____

Drilling Fluid _____

_____

Development Technique(s) and Date(s)

_____

_____

_____

Fluid Loss During Drilling _____ gallons

Water Removed During Development _____ gallons

Static Depth to Water _____ feet below M.P.

Pumping Depth to Water _____ feet below M.P.

Pumping Duration _____ hours

Yield _____ gpm Date _____

Specific Capacity _____ gpm/ft

Well Purpose _____

_____

_____

Remarks _____

_____

_____

_____

_____

_____

Prepared by _____

ATTACHMENT A-3

WATER SAMPLING LOG

GERAGHTY & MILLER, INC.
Environmental Services

WATER SAMPLING LOG

Project/No. _____ Page_____ of_____

Site Location _____

Site/Well No. _____ Coded/ Replicate No. _____ Date _____

Weather _____ Time Sampling Began _____ Time Sampling Completed _____

EVACUATION DATA

Description of Measuring Point (MP) _____

Height of MP Above/Below Land Surface _____ MP Elevation _____

Total Sounded Depth of Well Below MP _____ Water-Level Elevation _____

Held _____ Depth to Water Below MP _____ Diameter of Casing _____

Wet _____ Water Column in Well _____ Gallons Pumped/Bailed Prior to Sampling _____

Gallons per Foot _____

Gallons in Well _____ Sampling Pump Intake Setting (feet below land surface) _____

Evacuation Method _____

SAMPLING DATA/FIELD PARAMETERS

Color _____ Odor _____ Appearance _____ Temperature _____ °F/°C

Other (specific ion; OVA; HNU; etc.) _____

_____

Specific Conductance, umhos/cm _____ pH _____

Sampling Method and Material _____

Constituents Sampled	Container Description From Lab ____ or G&M ____	Preservative

Remarks _____

Sampling Personnel _____

WELL CASING VOLUMES

GAL./FT.							
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

APPENDIX B

Quality Assurance Project Plan

James Auer (Geraghty & Miller Project Manager) — Date: 04/20/94

Gregory Vanderlaan (Geraghty & Miller Project Officer) — Date: 04/20/94

Timothy Davis (Geraghty & Miller QA Officer) — Date: 04/20/94

USEPA On-Scene Coordinator — Date

QUALITY ASSURANCE PROJECT PLAN
PHASE II SITE INVESTIGATION
NAVISTAR INTERNATIONAL TRANSPORTATION COMPANY/
BURLINGTON NORTHERN RAILROAD/
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

June 1994

Prepared for

Navistar International Transportation Corporation
455 North Cityfront Plaza Drive
Chicago, Illinois 60601

and

Burlington Northern Railroad
4105 North Lexington Avenue, Suite 300
Arden Hills, Minnesota 55126-6181

Prepared by

Geraghty & Miller, Inc.
35 East Wacker Drive, Suite 1000
Chicago, Illinois 60601

CONTENTS

CONTENTS (continued)

TABLES

FIGURES

ATTACHMENT

QUALITY ASSURANCE PROJECT PLAN
PHASE II SITE INVESTIGATION
NAVISTAR INTERNATIONAL TRANSPORTATION COMPANY/
BURLINGTON NORTHERN RAILROAD/
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

INTRODUCTION

The United States Environmental Protection Agency (USEPA) requires that all environmental monitoring and measurement efforts mandated or supported by USEPA participate in a centrally managed quality assurance/quality control (QA/QC) program.

Any party generating data under this program has the responsibility to implement minimum procedures to assure that the precision, accuracy, completeness, and representativeness of its data are known and documented. To verify that the responsibility is met uniformly, each party must prepare a written Quality Assurance Project Plan (QAPjP) covering each project it is to perform.

This QAPjP presents the organization, objectives, functional activities and specific QA/QC activities associated with the Phase II Site Investigation for the Navistar International Transportation Company (Navistar), Burlington Northern Railroad (BNR), and Iowa Interstate Railroad (IIR) properties (the Navistar/BNR/IIR site). This QAPjP also describes the specific protocols that will be followed for sampling, sample handling and storage, chain of custody, and laboratory analysis.

All QA/QC procedures will be in accordance with applicable professional technical standards, USEPA requirements, government regulations and guidelines, and specific project goals and requirements. This QAPjP was prepared by Geraghty & Miller on behalf of the Respondents in accordance with USEPA QAPjP guidance documents, in particular, the Contract Laboratory Program (CLP) guidelines, Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-005/80), Quality Assurance/Quality Control Guidance

for Removal Activities (OSWER 9360.4-0-01), the Region V Model QAPjP (1991), and Extending the Tracking of Analytical Services to PRP-Lead Superfund Sites (OSWER 9360.2-02).

The following sections describe the site location, summarize the past data collection activities, discuss the project scope and objectives, and refer the reader to sections in the Sampling and Analysis Plan (SAP) where relevant information can be found.

1.0 PROJECT DESCRIPTION

This section describes the scope of work and project objectives for the Phase II Site Investigation to be performed at the Navistar/BNR/IIR site.

1.1 SITE DESCRIPTION

The Navistar/BNR/IIR site is located in Rock Island, Illinois. A site description including physical setting, surrounding land use, and geologic setting are provided in the Site Description section of the Work Plan (Section 2.0).

1.2 PROJECT OBJECTIVES AND SCOPE

The purpose of the Phase II Site Investigation is to collect and interpret additional hydrogeological data required to adequately define the nature and extent of petroleum hydrocarbon constituents on and in the groundwater and soil at the Navistar/BNR/IIR Site, as indicated in the June 1994 Administrative Order by Consent (the Order). After completion of the Phase II site investigation appropriate removal action goals will be developed, based on the nature and extent of affected soil and groundwater as defined by the Phase II Site Investigation. Subsequent to the development of removal action goals, removal actions to address any imminent and substantial threat to the public health or welfare, as a result of an actual or threatened discharge of oil and/or PCBs from the site, will be implemented.

The Phase II field investigation will include additional subsurface soil sampling at selected locations, and groundwater sampling from new and selected existing monitoring wells. Soil and groundwater samples will be analyzed for volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PNAs), and polychlorinated biphenyls (PCBs).

1.3 SAMPLE NETWORK DESIGN AND RATIONALE

The sample network design and rationale for sample locations is described in detail in the Phase II Site Investigation Scope of Work section of the Work Plan (Section 3.0).

1.4 PARAMETERS TO BE TESTED AND FREQUENCY

Sample matrices, analytical parameters, and frequencies of sample collection can be found in Table B1-1. The Phase II Site Investigation will include analyzing soil and groundwater samples for VOCs, PNAs, and PCBs.

1.5 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support decisions made during site investigation activities and are based on the end uses of the data to be collected. As such, different data uses may require different levels of data quality. From the "QA/QC Guidance for Removal Activities" (USEPA 1990), there are three analytical levels that address various data uses and the QA/QC effort and methods required to achieve the desired level of quality. These levels are:

- **Screening Objective (DQO Level 1)**: This objective for data quality is available for data collection activities that involve rapid, non-rigorous methods of analysis and quality assurance. These methods are used to make quick, preliminary assessments of types and levels of pollutants. Although there is no quality assurance data collected with the data at this objective, a calibration or performance check of the method is required along with verification of the detection level. This objective is generally applied to, but not limited to, the following activities: physical and/or chemical properties of samples; extent and degree of contamination relative to concentration differences; delineation of pollutant plume in groundwater; monitor well placement; waste compatibility; preliminary health and safety assessment; and preliminary identification and quantitation of pollutants. These types of data include those generated on-site through the use of HNu, pH, conductivity, and other real-time monitoring equipment at the site.

- **Verification Objective (DQO Level 2)**: This objective for data quality is available for data collection activities that require qualitative and/or quantitative verification of a "select portion of sample findings' (10% or more) that were acquired using non-rigorous methods of analysis and quality assurance. This quality objective is intended to give the decision-maker (Project Manager and/or OSC) a level of confidence for a select portion of the preliminary data. Generally the methods used for verification are more rigorous, as to analytical methodology and quality assurance. Only those verification methods that are analyte specific can be considered for this quality objective. This objective is generally applied, but not limited to, the following activities: physical and/or chemical properties of samples; extent and degree of contamination; verification of pollutant plume definition in groundwater; verification of health and safety assessment; verification of pollutant identification; and verification of cleanup. The soil and groundwater samples that will be submitted to the laboratory for analysis as part of the Phase II Site Investigation will follow the DQO Level 2 verification objective.

- **Definitive Objective (DQO Level 3)**: This objective for data quality is available for data collection activities that require a high degree of qualitative and quantitative accuracy of all findings using rigorous methods of analysis and quality assurance for "critical samples" (i.e., those samples for which the data are considered essential in making a decision). This quality objective is intended to give the decision maker (Project Manager or OSC) a level of confidence for a select group of "critical samples" such that a decision can be made based on an action level with regard to: treatment; disposal; site remediation and/or removal of pollutants; health risk or environmental impact; cleanup verification; pollutant source identification; delineation of contaminants; and other significant decision where an action level is concerned. Only those methods that are analyte specific can be used for this quality objective. No DQO Level # data will be collected during the Phase II Site Investigation.

1.6 PROJECT SCHEDULE

Sampling activities are planned to be performed during the summer of 1994. A project schedule is provided as Figure B1-2.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Under the direction of the USEPA On-Scene Coordinator (OSC), Geraghty & Miller has the overall responsibility for all phases of the investigation. Geraghty & Miller will perform the field investigation, prepare the Phase II Investigation report, and develop an appropriate removal (remedial) action alternative. Project management will also be provided by Geraghty & Miller. A project organization and responsibility chart depicting management structure and lines of communication is presented on Figure B2-1. The project organization chart identifies the Project Officer, Project Manager, and other personnel that will be responsible for achievement of the project objectives and completion of the scope of work. The various QA/QC and management responsibilities of key project personnel are defined below.

On-Scene Coordinator

The OSC will be responsible for overseeing the implementation of the Order. The OSC will have the authority vested in an OSC by the National Contingency Plan (NCP), including the authority to halt, conduct, or direct any work required by the Order or any other response action undertaken by the Respondents or USEPA at the site.

Geraghty & Miller Project Officer

The Project Officer has overall responsibility for ensuring that the project meets EPA objectives and Geraghty & Miller quality standards. In addition, he is responsible for technical quality control and project oversight, and will provide the Project Manager with access to corporate management.

Geraghty & Miller Project Manager

The Geraghty & Miller Project Manager is responsible for implementing the project, and has the authority to commit the resources necessary to meet project objectives and requirements. The Project Manager's primary function is to ensure that technical, financial, and scheduling

objectives are achieved successfully. The Project Manager will report directly to the OSC and will provide the major point of contact and control for matters concerning the project. The Project Manager will:

- Define project objectives and develop a detailed work plan schedule.
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task.
- Acquire and apply technical and corporate resources as needed to ensure performance within budget and schedule constraints.
- Orient the Field Team Leader and support staff concerning the project scope of work and objectives.
- Monitor and direct the Field Team Leader and Field Staff.
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product.
- Review the work performed on each task to ensure its quality, responsiveness, and timeliness.
- Review and analyze overall task performance with respect to planned requirements and authorizations.
- Approve all external reports (deliverables) before their submission to USEPA Region V.

- Ultimately be responsible for the preparation and quality of interim and final reports.

- Represent the project team at meetings and public hearings.

Field Team Leader

The Geraghty & Miller Project Manager will be supported by the Field Team Leader who is responsible for leading and coordinating the day-to-day activities of the various resource specialists under his supervision. The Field Team Leader will be an experienced environmental professional and will report directly to the Project Manager. Specific Field Team Leader responsibilities include:

- Provision of day-to-day coordination with the Project Manager on technical issues in specific areas of expertise.

- Development and implementation of field-related work plans, assurance of schedule compliance, and adherence to management-developed study requirements.

- Coordination and management of field staff including sampling, drilling, and field laboratory staff.

- Implementation of QC for technical data provided by the field staff including field measurement data.

- Adherence to work schedules provided by the Project Manager.

- Authorship, review, and approval of text and graphics required for field team efforts.

- Coordination and oversight of technical efforts of subcontractors assisting the field team.

- Identification of problems at the field team level, discussion of resolutions with the site manager, and provision of communication between team and upper management.

- Participation in the preparation of the final report.

Technical Staff

The technical staff (team members) for this project will be drawn from Geraghty & Miller's pool of corporate resources. The technical team staff will be utilized to gather and analyze data, and to prepare various task reports and support materials. All of the designated technical team members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

QA Officer

The QA Officer will remain independent of direct project involvement and day-to-day operations, and has direct access to corporate executive staff as necessary to resolve any QA dispute. He is responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations, Geraghty & Miller's policies, and USEPA requirements. Specific functions and duties include:

- Provide QA audit on various phases of the field operations.

- Review and approval of QA plans and procedures.

- Providing QA technical assistance to project staff.

- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the project officer.

Laboratory Project Manager (Dawn Siekerman)

- Ensures all resources of the laboratory are available on an as-needed basis.
- Overview of final analytical reports.
- Approval of the QAPjP.

Laboratory Operations Manager/Director (Melody Carroll)

- Coordinates laboratory analyses.
- Supervises in-house chain-of-custody.
- Schedules sample analyses.
- Oversees data review.
- Oversees preparation of analytical reports.
- Approves final analytical reports prior to submission to Geraghty & Miller.

Laboratory Quality Assurance Officer (Christine Sarkan)

- Overview laboratory quality assurance.

- Overview QA/QC documentation.
- Conduct detailed data review.
- Decides laboratory corrective actions, if required.
- Technical representation of laboratory QA procedures.
- Preparation of laboratory Standard Operation Procedures.
- Approval of the QAPjP.

Laboratory Sample Custodian (Kathy Young)

- Receive and inspect the incoming sample containers.
- Record the condition of the incoming sample containers.
- Sign appropriate documents.
- Verify chain of custody and its correctness.
- Notify laboratory manager and laboratory supervisor of sample receipt and inspection.
- Assign a unique identification number and customer number, and enter each into the sample receiving log.
- With the help of the laboratory manager, initiate transfer of the samples to appropriate lab sections.

- Control and monitor access/storage of samples and extracts.

Primary responsibility for project quality rests with the Geraghty & Miller Project Manager. Independent quality assurance will be provided by the Laboratory Project Manager and QA Officer prior to release of all data to Geraghty & Miller.

3.0 QUALITY ASSURANCE OBJECTIVES FOR DATA MEASUREMENT

The overall QA/QC objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analyses, and reporting that will provide results which are legally defensible in a court of law. Specific procedures for sampling, chain of custody, laboratory instruments calibration, laboratory analyses, reporting of data, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPjP. The purpose of this section is to address the specific objectives for accuracy, precision, completeness, representativeness, and comparability.

3.1 LEVEL OF QUALITY CONTROL EFFORT

Field blank, trip blank, duplicate, and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling program. Field and trip blanks consisting of distilled water will be submitted to the analytical laboratory to provide the means to assess the quality of the data resulting from the field sampling program. Field blank samples are analyzed to check for procedural contamination at the site that may cause sample contamination. Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage. Duplicate samples are analyzed to check for sampling and analytical reproducibility. Matrix spikes provide information about the effect of the sample matrix on the digestion and measurement methodology. All matrix spikes are performed in duplicate and are hereinafter referred to as MS/MSD samples. One MS/MSD will be collected for every 20 or fewer investigative samples. MS/MSD samples are collected only for organic analyses.

The general level of the QC effort will be one field duplicate and one field blank for every 10 or fewer investigative samples. One laboratory supplied trip blank consisting of distilled deionized ultra pure water will be included along with each shipment of aqueous samples to be analyzed for VOCs.

MS/MSD samples are investigative samples. Soil MS/MSD samples require no extra volume for VOCs or extractable organics. However, aqueous MS/MSD samples must be collected at triple the volume for VOCs and double the volume for extractable organics. One MS/MSD sample will be collected for every 20 or fewer investigative samples per sample matrix. The number of duplicate and field blank samples to be collected are listed in Table 1-1. Sampling procedures are specified in the Sampling and Analysis Plan (SAP).

The level of QA/QC effort provided by the laboratory will meet DQO Level II. The level of QA/QC effort for testing of VOCs, PNAs, and PCBs will conform to the protocols of USEPA Methods 8240, 8310, and 8080.

The QA/QC level of effort for the field measurement of pH consists of pre-measurement calibration and a post-measurement verification using two standard reference solutions as appropriate to the sample pH. This procedure will be performed at the initiation and conclusion of each day of sampling. The QA/QC effort for field conductivity measurements will include daily calibration of the instrument using standard solutions of known conductivity.

3.2 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSIS

The fundamental QA objective with respect to accuracy, precision, and sensitivity of laboratory analytical data is to achieve the QC acceptance criteria of the analytical protocols. Standard operating procedures (SOPs) for laboratory analyses are provided in Attachment B-1. These include the required accuracy, precision, and sensitivity of the analyses. SOPs for the field equipment to measure pH, conductivity, and temperature are also presented in Attachment B-1. Accuracy and precision requirements for field screening analyses are included with the SOPs.

3.3 COMPLETENESS, REPRESENTATIVENESS AND COMPARABILITY

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. It

is expected that the Project Laboratory, Heritage Laboratories, Inc. of Romeoville, Illinois will provide data meeting QA/QC acceptance criteria for 95 percent or more for all soil and aqueous samples tested using USEPA Method 8240 for VOCs, USEPA Method 8310 for PNAs, and USEPA Method 8080 for PCBs. Following completion of the analytical testing, the percent completeness will be calculated using the following equations:

$$Completeness(\%) = \frac{Number\ of\ valid\ data}{Number\ of\ samples\ collected\ for\ each\ parameter}$$

Representativeness expresses the degree to which the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocol. The sampling network was designed to provide data representative of site conditions. During development of this network, consideration was given to past site practices, existing analytical data, physical setting and processes, and constraints inherent to the removal program. The rationale of the sampling network is discussed in detail in the SAP. Representativeness will be satisfied by insuring that the SAP is followed, proper sampling technique are used, proper analytical procedure are followed, and holding times of the samples are not exceeded in the laboratory. Representativeness will be assessed by the analyses of field duplicated samples.

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as documented in the QAPjP, are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of difference in procedures and QA/QC objectives.

4.0 SAMPLING PROCEDURES

Sampling procedures are described in the SAP which is provided in Appendix A of the Work Plan.

5.0 SAMPLE CUSTODY

It is USEPA Region V Policy to follow the USEPA Region V sample custody, or chain-of-custody protocols as described in "NEIC Policies and Procedures", EPA-330/9-78DDI-R, Revised June 1985. This custody is in three parts: sample collection, laboratory analysis, and final evidence files. Final evidence files, including all originals of laboratory reports and purge files, are maintained under document control in a secure area.

A sample or evidence file is under your custody if they:

- Are in your possession;
- Are in your view subsequent to being in your possession;
- Are in your possession and you place them in a secured location; or,
- Are in a designated secure area.

5.1 FIELD CHAIN-OF-CUSTODY PROCEDURES

The sample packaging and shipment procedures summarized below will insure that the samples will arrive at the laboratory with the chain-of-custody intact. The protocol for specific sample numbering and other sample designations are included in the SAP.

5.1.1 Field Procedures

(a) The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.

(b) All bottles will be labeled with sample numbers and respective sampling locations and/or sampling intervals.

(c) Sample labels are to be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample tag because the ballpoint pen would not function in freezing weather.

(d) The OSC will review all field activities to determine whether proper custody procedures were followed during the field work and decide if additional samples are required as a result of improper field sampling procedures.

5.1.2 Field Logbooks/Documentation

The field logbook(s) will provide the means of recording data collecting activities performed. As such, entries will be described in as much detail as possible so that persons going to the site could re-construct a particular situation without reliance on memory.

Field logbooks will be bound, field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the document control center when not in use. Each logbook will be identified by the project-specific document number.

The title page of each logbook will contain the following:

- Person to whom the logbook is assigned.
- Logbook number.
- Project name.
- Project start date.
- End date.

Entries into the logbook will contain a variety of information including the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the site, field sampling or investigation team personnel, and the purpose of their visit will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. All entries will be made in ink and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark. Whenever a sample is collected, or a measurement is made, a detailed description of the location of the station, which may include compass and distance measurements (if necessary or not obvious), shall be recorded. The number of the photographs taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures documented in the SAP. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, and volume and number of containers. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples, which will receive separate sample identification numbers, will be noted under sample description.

5.1.3 Transfer of Custody and Shipment Procedures

(a) Samples are accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of the custody of the samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage area.

(b) Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analyses, with a signed custody record enclosed with each shipment. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory. The preferred procedure includes the use of a custody seal attached to the front right and back left of the cooler. The custody seals are covered with clear plastic tape. The cooler is strapped shut with strapping tape in at least two locations.

(c) Whenever samples are co-located with a source or government agency, a separate sample receipt is prepared for those samples and marked to indicate with whom the samples are being co-located. The person relinquishing the samples to the facility or agency should request the representatives signature acknowledging sample receipt. If the representative is unavailable or refuses, this is noted in the "Received By" space.

(d) All shipments will be accompanied by the chain-of-custody record that identifies the contents of the shipping container. The original record will accompany the shipment, and the pink and yellow copies will be retained by the sampler for returning to the sampling office.

(e) If the samples are sent by common carrier, a bill of lading should be used. Receipts of bills of lading will be retained as part of the permanent documentation. If sent by mail, the package will be registered with return receipt requested. Commercial carriers are not required to sign off on the chain-of-custody form provided that they are sealed inside the sample cooler and the custody seals remain intact.

5.2 LABORATORY CHAIN-OF-CUSTODY PROCEDURES

Laboratory custody procedures for sample receiving and log-in, sample storage, tracking during sample preparation and analysis, and storage of data are described in the laboratory SOPs provided in Attachment B-1.

5.3 FINAL EVIDENCE FILES CUSTODY PROCEDURES

The evidence files for analytical data are maintained at the Geraghty & Miller Chicago office. The content of the evidence file will include all relevant records, reports, correspondence, logs, field logbooks, laboratory sample preparation and analysis logbooks, data packages, pictures, subcontractor's reports, chain-of-custody records, and data review reports. The evidence file will be under custody of the Geraghty & Miller Project Manager in a secured area.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy of all instruments and measuring equipment that are used for conducting field tests and laboratory analyses. The instruments and equipment should be calibrated prior to each use or on a scheduled, periodic basis.

6.1 FIELD INSTRUMENTS/EQUIPMENT

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

Equipment to be used during the field sampling will be examined to certify that it is operating condition. This includes checking the manufacturer operating and instruction manual(s) for each instrument to verify that all operation and maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed such that the notation on any prior equipment problem are not overlooked, and all necessary repairs to equipment have been carried out. A spare electrode will be sent with each pH meter to be used for field measurements. Two thermometers will be sent to sampling locations where measurement of temperature is required, including those locations where a specific conductance probe/thermometer is required.

Calibration of field instruments is governed by the specific SOPs for the applicable field analysis method, and such procedures take precedence over the following general discussion.

Calibration of field instruments will be performed at the intervals specified by the manufacturer or more frequently as conditions dictate. Field instruments will include a pH meter, thermometer, specific conductivity meter, and Organic Vapor Analyzer (OVA) or Organic Vapor Photoionization Detector (PID). In the event that an internally calibrated field

instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service.

The pH meter will be calibrated with standard buffer solutions prior to a field trip. In the field, the meter will be calibrated daily with two buffers before use and at the conclusion of each sampling day. Calibration procedures and frequency will be recorded in a field log book. General procedures for pH meter, specific conductivity meter and thermometer calibration are described below:

pH Calibration

- Temperature of sample and buffer should be the same.
- Connect pH electrode into pH meter and turn on pH meter.
- Set temperature setting based on the temperature of buffer; place electrode in first buffer solution.
- After reading has stabilized, adjust "CALIB" knob to display correct value.
- Repeat procedure for second buffer solution.
- Place pH electrode in the sample and record the pH as displayed.
- Remove pH electrode from sample and rinse off with distilled water.
- The pH meter must be recalibrated every time it is turned off and turned back on, or if it starts giving erratic results.

The calibrations performed, standards used, and sample pH values are to be recorded in the field notebook or on appropriate sample collection logs. Appropriate new batteries will be purchased and kept with the meters to facilitate immediate replacement in the field as necessary.

Temperature Calibration

Temperature measurements are carried out utilizing a thermometer. The thermometers must be inspected before use to determine whether there is any mercury separation. The thermometers should be rechecked in the field before and after use to see if the readings are logical and the mercury is still intact. The thermometers should be checked biannually for calibration, by immersing them in a bath of known temperature until equilibrium is reached. They should be discarded if found to have more than 10% error. The reference thermometer used for the bath calibration should be National Bureau of Standards (NBS) traceable.

Conductivity Meter Calibration

The conductivity cells of the specific conductivity meter will be cleaned and checked against known conductivity standards before each field trip. In the field, the instrument will be checked daily with National Bureau of Standards (NBS) traceable standards. The calibration procedure is described below.

- Place the probe in the conductivity calibration standard solution.
- Set temperature knob for temperature of standard solution.
- Turn to appropriate scale and set the instrument for the value of calibration standard.
- Rinse off the electrode with distilled water.

- Measure the conductivity for distilled water to be used for a field blank, making sure temperature is set correctly for temperature of solution to be tested.

- If the conductivity of blank (distilled water) is high, it must be discarded and a new blank sample procured.

All readings and calibrations should be recorded in the field notebook.

The OVA will be checked daily by use of the internal calibration mechanism. The PID will be calibrated daily with a gas of known concentration.

6.2 LABORATORY INSTRUMENTS

Calibration of laboratory equipment will be based on approved written procedures. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing quality control activities. These records will be filed at the location where the work is performed and will be subject to QA audit. For all instruments, the laboratory will maintain a factory-trained repair staff with in-house spare parts or will maintain service contracts with vendors.

The records of calibration will be kept as follows:

- If possible, each instrument will have record of calibration permanently affixed with an assigned record number.

- A label will be affixed to each instrument showing the description, manufacturer, model numbers, date of last calibration, by whom calibrated (signature), and due date of next calibration report. Compensation or correction figures will also be maintained with instrument.

- A step-by-step calibration procedure will be available for each piece of test and measurement equipment.

- Any instrument that is not calibrated to the manufacturer's original specification will display a warning tag to alert that analyst that the device only has a "Limited Calibration".

In all cases where analyses are conducted according to the USEPA Contract Laboratory Program (CLP) or SW-846 protocols, the calibration procedures and frequencies specified in the applicable CLP Routine Analytical Services (RAS) Statement of Work (SOW) or SW-846 methods will be followed exactly. For analyses governed by SOPs, see the appropriate SOP for the required calibration procedures and frequencies.

Prior to calibration, the instrument(s) used for gas chromatograph/mass spectrometer (GC/MS) analyses are tuned by the analysis of p-bromofluorobenzene (BFB) for volatile analyses and decafluorotriphenyl phosphine (DFTPP) for semi-volatile analyses. Once the tuning criteria for these reference compounds are met, the instrument will be initially calibrated by using a five-point calibration curve. The instrument tune will be verified each 12 hours of operation or at least each working day using criteria specified by the method. The calibration standards will be USEPA-or NBS-traceable and are spiked with internal standards and surrogate compounds. Whereas, calibration and continuing calibration verification of instruments will be performed at approved intervals as specified by the manufacturer or the analytical method (whichever is more frequent). Calibration standards used as reference standards will be traceable to the NBS or USEPA when existent.

7.0 ANALYTICAL PROCEDURES

All soil and groundwater samples collected during the field sampling activities for the Phase II Site Investigation will be analyzed by Heritage Laboratories.

7.1 LABORATORY ANALYSIS

Analytical methods have been selected which provide detection limits in water that are lower than the State drinking water limits for compounds of interest. USEPA Methods 8240, 8310, and 8080 will be utilized for the sample analyses. SOPs for these methods are provided in Attachment B-1.

Each of these SOPs is based on an analytical method published in SW-846 which specifies:

- Procedures for sample preparation.
- Instrument start-up and performance check.
- Procedures to establish the actual and required detection limits for each parameter.
- Initial and continuing calibration check requirements.
- Specific methods for each sample matrix type.
- Required analyses and QC acceptance limits for method blanks, trip blanks (as appropriate), field blanks, matrix spikes, matrix spike duplicates, and laboratory control samples (USEPA or NBS) reference samples or laboratory prepared blank/spikes).

Table B7-1 summarizes the analyte group and USEPA method from which each SOP is derived for chemical analyses.

7.2 FIELD SCREENING ANALYTICAL PROTOCOLS

The procedures for field measurement of pH, specific conductivity, and temperature are also described in the field SOPs provided in Attachment B-1.

7.3 LABORATORY PROCEDURES

Laboratory procedures used for analyzing the environmental samples will be performed in accordance with those specified in the associated laboratory SOPs and applicable USEPA guidance.

8.0 INTERNAL QUALITY CONTROL CHECKS

This section describes the QA/QC procedures to be followed in the field and the laboratory to verify the integrity of the data that are collected.

8.1 FIELD SAMPLE COLLECTION

The assessment of field sampling precision and accuracy will be made through collection of field duplicates and field blanks in accordance with the applicable procedures described in the SAP at the frequency indicated in the SAP.

8.2 FIELD MEASUREMENT

QC procedures for pH, conductivity, and temperature measurements are limited to checking the reproducibility of the measurement by obtaining multiple readings on a single sample or standard and by calibrating the instruments.

8.3 LABORATORY ANALYSIS

Two types of quality assurance will be used by Heritage Laboratories to ensure the production of analytical data of known and documented usable quality consisting of the internal quality assurance program and quality control checks.

8.4 QA/QC PROGRAM

The project laboratory has a written QA/QC program that provides rules and guidelines to verify the reliability and validity of work conducted at the laboratory. Compliance with the QA/QC program is coordinated and monitored by the laboratory's quality assurance unit (QAU), which is independent of the operating departments.

The stated objectives of the laboratory QA/QC Program are to:

- Ensure that all procedures are documented, including any changes in administrative and/or technical procedures.

- Ensure that all analytical procedures are conducted according to sound scientific principles and have been validated.

- Monitor the performance of the laboratory by a systemic inspection program and provide for corrective actions as necessary.

- Collaborate with other laboratories in establishing quality levels, as appropriate.

- Ensure that all data are properly recorded and archived.

All laboratory procedures are documented in writing as either SOPs or Method Procedures (MPs) that are edited and controlled by the QAU. Internal quality control procedures for analytical services will be conducted by the laboratory in accordance with its SOPs and the individual method requirements in a manner consistent with appropriate USEPA analytical methods.

8.5 QUALITY CONTROL CHECKS

These specifications include the types of audits required (sample spikes, surrogate spikes, reference samples, controls, and blanks), the frequency of each audit, the compounds to be used for sample spikes and surrogate spikes, and the quality control acceptance criteria for these audits. Additionally, the USEPA may submit a performance evaluation sample to the project laboratory.

The project laboratory will document, in each data package provided, that both initial and ongoing instrument and analytical QC functions have been met. Any samples analyzed in non-

conformance with the QC criteria will be reanalyzed by the laboratory, if sufficient sample volume is available. It is expected that sufficient volume of samples will be collected for reanalyses.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

This section describes the data reduction, validation, and reporting procedures to be followed to verify the integrity of the data.

9.1 FIELD MEASUREMENTS AND SAMPLE COLLECTION

Raw data from field measurements and sample collection activities will be appropriately recorded in the field log book. If the data are to be used in the project reports, they will be reduced summarized and the method of reduction will be documented in the report.

9.2 LABORATORY SERVICES

Heritage Laboratories will perform in-house analytical data reduction and validation under the direction of the Laboratory QA Officer. The Laboratory QA Officer is responsible for assessing data quality and advising of any data which were rated "preliminary" or "unacceptable" or other notations which would caution the data user of possible unreliability. Data reduction, validation, and reporting by either laboratory will be conducted as follows:

- Raw data produced by the analyst is turned over to the respective area supervisor.

- The area supervisor reviews the data for attainment of quality control criteria as outlined in the USEPA QA/QC Guidance for Removal Activities (USEPA 1990).

- Upon acceptance of the raw data by the area supervisor, a computerized report is generated and sent to the Laboratory QA Officer.

- The Laboratory QA Officer will complete a thorough audit of reports at a frequency of one in ten, and an audit of every report for consistency.

- The QA Officer and area supervisors will decide whether any sample reanalysis is required.

- Upon acceptance of the preliminary reports by the QA Officer, final reports will be generated and signed by the Laboratory Project Manager. The laboratory package shall be presented in the same order in which the samples were analyzed.

Data reduction reporting procedures will be in accordance with Level II DQOs of the QA/QC Guidance for Removal Activities (USEPA 1990).

The project laboratory will prepare and retain full analytical and QC documentation similar to that required by the Contact Laboratory Program. Such retained documentation need not be hard (paper) copy, but may be in other storage media (e.g.., magnetic tape). As needed, the laboratory will supply hard copy of the retained information.

The laboratory will report the data in the same chronological order in which it is analyzed along with QC data. The laboratory will provide the following information to Geraghty & Miller in each analytical data package submitted:

- Cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis.

- Tabulated results of inorganic and organic compounds identified and quantified.

- Analytical results for QC sample spikes, sample duplicates, initial and continuous calibration verifications of standards and blanks, standard procedural blanks, laboratory control samplers, and ICP interference check samples.

- Tabulation of instrument detection limits determined in pure water.

- Raw data system printouts (or legible photocopies) identifying date of analyses, analyst, parameters determined, calibration curve, calibration verifications, method blanks, sample and any dilutions, sample duplicates, spikes, and control samples.

For organic analyses, the data packages must include matrix spikes, matrix spike duplicates, surrogate spike recoveries, chromatogram, GC/MS spectra and computer printouts. The data package will be reported to the Agencies for assessment.

Geraghty & Miller's assessment will be accomplished by the joint efforts of the Data Reviewer and Project Manager. The data assessment by the Project Manager will be based on the criteria that the sample was properly collected and handled according to the SAP and the Sample Custody section of this QAPjP (Section 5.0).

The Geraghty & Miller Data Reviewer will conduct a systematic review of the data for compliance with the established QC criteria based on the spike, duplicate and blank results provided by the laboratory. An evaluation of data accuracy, precision, sensitivity, and completeness, will be performed and presented in the Phase II Site Investigation report based on data validation procedures outlined in the QA/QC Guidance for Removal Activities (USEPA 1990).

The data validation process will identify any out-of-control data points and data omissions and interact with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses may be made by the Project Manager based on the extent of the deficiencies and their importance in the overall context of the project. The OSC shall also have the authority to order resampling based on data deficiencies.

All data generated for the Phase II Site Investigation will be computerized in a format organized to facilitate data review and evaluation. The computerized data set will include the data flags provided by Heritage Laboratories in accordance with the Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (February 1988) as well as additional comments of the data validation. The laboratory-provided data flags will include such items as: 1) concentration below required detection limit; 2) estimated concentration due to poor spike recovery; and 3) concentration of chemical also found in laboratory blank. The data validation comments will indicate that the data are: 1) usable as a quantitative concentration; 2) usable with caution as an estimated concentration; or 3) unusable due to out-of-control QA/QC results.

The Phase II Site Investigation data set will be available for controlled access by the Project Manager, and authorized personnel using a site-specific code. The complete data set will be incorporated into the Phase II Site Investigation report.

10.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the SAP and QAPjP. The audits of field and laboratory activities include two separate independent parts: Internal and External audits.

10.1 FIELD AUDITS

Internal audits of field activities (sampling and measurements) will be conducted by the Geraghty & Miller QA Officer and/or Field Team Leader. The audits will include examination of field sampling records, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA/QC procedures, and chain-of-custody. These audits will occur at the onset of the project to verify that all established procedures are followed. Follow-up audits will be conducted to correct deficiencies, and to verify that QA procedures are maintained throughout the removal action. The audits will involve review of field measurement records, instrumentation calibration records, and sample documentation.

External audits may be conducted by USEPA Region V Central Regional Laboratory (CRL) and/or Central District Office (CDO).

10.2 LABORATORY AUDITS

The internal performance and system audits of laboratories will be conducted by the Geraghty & Miller QA Officer and/or Project Manager. The system audits, which will be done on a annual basis, will include examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedure, sample preparation and analysis, and instrument operating records. The performance audits will be conducted on a quarterly basis. Blind QC samples will be prepared and submitted along with project samples to the laboratory

for analysis throughout the project. The QA Officer will evaluate the analytical results of these blind performance samples to verify that the laboratories maintain a good performance.

External performance and system audits of the laboratories selected for the project for approval/disapproval may be conducted by the USEPA Regional V CRL.

11.0 PREVENTATIVE MAINTENANCE PROCEDURES

This section describes the preventative maintenance procedures used on the field and laboratory equipment to ensure the integrity of the data.

11.1 FIELD EQUIPMENT AND INSTRUMENTS

The field equipment for this project include a thermometer, pH meter, and conductivity meter. Specific preventative maintenance procedures to be followed for field equipment are those recommended by the manufacturer.

Field instruments will be checked and calibrated before they are shipped or carried to the field. These instruments will be checked and calibrated daily before use. Calibration checks will be performed after every 10 samples and will be documented in the field notebook.

Critical spare parts such as pH probes, electrodes, and batteries will be kept on-site to minimize instrument down time. Backup instruments and equipment will be available on-site or within one-day shipment to avoid delays in the field schedule.

11.2 LABORATORY INSTRUMENTS

As part of its QA/QC Program, a routine preventative maintenance program is conducted by Heritage Laboratories to minimize the occurrence of instrument failure and other system malfunctions. Heritage Laboratories has an internal group to perform routine scheduled maintenance, and to repair or to coordinate with the vendor for the repair of all instruments. All laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific method employed. This maintenance is carried out on a regular, scheduled basis, and is documented in the laboratory instrument service logbook for each instrument. Emergency repair or scheduled manufacturer's maintenance is provided under a repair and maintenance contract with factory representatives. Routine preventative maintenance is completed by the laboratory in a manner consistent with USEPA guidelines and preventative maintenance schedules are presented in Table B11-1.

12.0 DATA PRECISION AND ACCURACY PROCEDURES

This section describes specific routine procedures used to assess the precision and the accuracy of the data.

12.1 FIELD MEASUREMENTS

Field data will be assessed by the site QA Officer. The QA Officer will review the field results for compliance with the established QC criteria that are specified in the QAPjP and SAP. Accuracy of the field measurements will be assessed using daily instrument calibration, calibration check, and analysis of blanks. Precision will be assessed on the basis of reproducibility by multiple reading of a single sample. Data completeness will be calculated using Equation 12-1.

$$Completnesses = \frac{Valid\ Data\ Obtained}{Total\ Data\ Planned} \times 100 \qquad Equ.12\text{-}1$$

12.2 LABORATORY DATA

Laboratory results will be assessed for compliance with required precision, accuracy, completeness, and sensitivity as discussed in the following sections.

12.2.1 Precision

Precision of laboratory analysis will be assessed by comparing the analytical results between MS/MSD for organic analysis, and laboratory duplicate analyses for inorganic analysis. The relative percent difference (%RPD) will be calculated for each pair of duplicate analysis using the Equation 12-2.

$$\%\ RPD = \frac{S - D}{(S + D)/2} \times 100 \qquad Equ.\ 12\text{-}2$$

Where: S = First sample value (original or MS value)

D = Second sample value (duplicate or MSD value)

12.2.2 Accuracy

Accuracy of laboratory results will be assessed for compliance with the established QA/QC criteria that are described in the Quality Assurance Objectives section of this QAPjP (Section 3.0) using the analytical results of method blanks, reagent blanks, MS/MSD samples, field blanks, and bottle blanks. The percent recovery (%R) of matrix spike samples will be calculated using Equation 12-3.

$$\% R = \frac{A - B}{C} \times 100 \qquad Equ.\ 12\text{-}3$$

Where: A = The analyte concentration determined experimentally from the spiked sample.

B = The background level determined by a separate analysis of the unspiked sample.

C = The amount of the spike added.

12.2.3 Completeness

The data completeness of laboratory analyses results will be assessed for compliance with the amount of data required for decision making. The completeness is calculated using Equation 12-1.

12.2.4 Sensitivity

The achievement of method detection limits depend on instrument sensitivity and matrix effects. Therefore it is important to monitor the instrumental sensitivity to verify that the data quality through constant instrument performance. The instrumental sensitivity will be monitored through the analysis of method blank, calibration check sample, and laboratory control samples.

13.0 CORRECTIVE ACTIONS

Corrective actions may be required for two classes of problems: analytical and equipment problems and noncompliance problems. Analytical and equipment problems may occur during sampling and sample handling, sample preparation, laboratory instrument analyses, and data review.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the Geraghty & Miller Project Manager. If the problem is analytical in nature, information on these problems will be promptly communicated to the OSC. Implementation of corrective action will be confirmed in writing through the same channels.

Any nonconformance with the established quality control procedures in the QAPjP or SAP will be identified and corrected in accordance with the QAPjP. The OSC or designee will issue a Nonconformance Report for each nonconformance condition.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by stop-work order by the OSC or the Geraghty & Miller Project Manager.

13.1 SAMPLE COLLECTION/FIELD MEASUREMENTS

Technical staff and project personnel will be responsible for reporting all suspected technical or QA nonconformances, or suspected deficiencies of any activity or issued document by reporting the situation to the Geraghty & Miller Field Team Leader or designee. The Field Team Leader will be responsible for assessing the suspected problems in consultation with the Project Manager to make a decision based on the potential for the situation to impact the quality of the data. If it is determined that the situation warrants a reportable nonconformance requiring corrective action, then a nonconformance report will be initiated by the Field Team Leader.

The Field Team Leader will be responsible for ensuring that corrective action for nonconformances are initiated by:

- Evaluating all reported nonconformances.
- Controlling additional work on nonconforming items.
- Determining disposition or action to be taken.
- Maintaining a log of nonconformances.
- Reviewing nonconformance reports and corrective actions taken.
- Ensuring nonconformance reports are included in the final site documentation in project files.

If appropriate, the Geraghty & Miller Field Team Leader will ensure that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed.

Corrective action for field measurements may include:

- Repeat the measurement to check the error.
- Check for all proper adjustments for ambient conditions such as temperature.
- Check the batteries.
- Recalibration.

- Check the calibration.

- Replace the instrument or measurement devices.

- Stop work (if necessary).

The Field Team Leader or designee is responsible for all site activities. In this role, the Geraghty & Miller Project Manager at times is required to adjust the site programs to accommodate site specific needs. When it becomes necessary to modify a program, the responsible person notifies the Project Manager or Field Team Leader of the anticipated change and implements the necessary changes after obtaining the approval of the Project Manager. The change in the program will be documented as a field change request (FCR) that will be signed by the initiators and the Field Team Leader. The FCR for each document will be numbered serially as required. The FCR shall be attached to the file copy of the affected document. The Geraghty & Miller Project Manager must approve the change in writing or verbally prior to field implementation, if feasible. If unacceptable, the action taken during the period of deviation will be evaluated in order to determine the significance of any departure from established program practices and action taken.

The Geraghty & Miller Project Manager for the Phase II Site Investigation site is responsible for the controlling, tracking, and implementation of the identified changes. Reports on all changes will be distributed to all affected parties including the OSC. The OSC will be notified whenever program changes in the field are made.

13.2 LABORATORY ANALYSES

Corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The investigative action taken is somewhat dependent on the analysis and the event.

Laboratory personnel are alerted that corrective actions may be necessary if:

- QC data are outside the warning or acceptable windows for precision and accuracy.
- Blanks contain target analytes above acceptable levels.
- Undesirable trends are detected in spike recoveries or RPD between duplicates.
- There are unusual changes in detection limits.
- Deficiencies are detected during internal or external audits or from the results of performance evaluation samples.
- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, and checks the instrument calibration, spike and calibration mixes, and sensitivity. If the problem persists or cannot be identified, the matter is referred to the laboratory supervisor, manager, and/or QA department for further investigation. Once resolved, full documentation of the corrective action procedure is filed with the QA department.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

In addition to the audit reports submitted to the Project Manager, a monthly progress report is submitted to the OSC and Geraghty & Miller Project Officer that addresses QA/QC issues. The final Phase II Site Investigation Report will contain QA sections that summarize data quality information collected during the project. The following QA items (if applicable) will be discussed in the data validation section of the final report.

- Changes in QA Project Plan.
- Summary of QA/QC Programs, Training, and Accomplishments.
- Results of Technical Systems and Performance Evaluation Audits.
- Significant QA/QC Problems, Recommended Solutions, and Results of Corrective Actions.
- Data Quality Assessment in Terms of Precision, Accuracy, Representativeness, Completeness, Comparability, and Method Detection Limit.
- Indication of whether the QA Objectives were met.
- Limitations on Use of the Measurement Data.

The Geraghty & Miller Project Officer reviews and is responsible for the QA/QC of the final Phase II Site Investigation report(s).

C10299.003\QAPJP.RPT\jpa

TABLES

Table B1-1. Summary of Sampling and Analysis Program..A31

Sample Type	Field Measurements and Observations	Laboratory Parameters [2]	Analytical Method	DQO Analytical Level	# of Samples	QUALITY CONTROL SAMPLES # of Field Duplicates	# of Equipment Blanks	# of MS/MSD	Total # of Samples
Soil	- Organic vapor screening using PID or FID [1]	VOCs	8240	IV	24	0	0	2	26
		PNAs	8310	IV	24	0	0	2	26
		PCBs	8080	IV	24	0	0	2	26
Groundwater	- pH - Specific Conductance - Temperature - Qualitative observation of color and turbidity	VOCs	8240	IV	22	3	5	2	32
		PNAs	8310	IV	22	3	3	2	30
		PCBs	8080	IV	22	3	3	2	30

1 PID/FID screening will provide qualitative information regarding the concentration of VOCs in the sample and provide information for health and safety purposes.

2 All water samples are unfiltered; VOCs = Volatile Organic Compounds; PNAs = polynuclear aromatic hydrocarbons; PCBs = polychlorinated biphenyls.

CI0299.003\TBL-B1-1.XLS

Table B3-1. VOC Constituent List and Contract Required Quantitation Limits (CRQL)

Volatiles	CAS Number	Quantitation Limits* Water (ug/L)	Low Soil (ug/Kg)	Med. Soil (ug/Kg)	On Column (ng)
Chloromethane	74-87-3	10	10	1200	(50)
Bromomethane	74-83-9	10	10	1200	(50)
Vinyl Chloride	75-01-4	10	10	1200	(50)
Chloroethane	75-00-3	10	10	1200	(50)
Methylene Chloride	75-09-2	5	5	1200	(50)
Acetone	67-64-1	10	10	1200	(50)
Carbon Disulfide	75-15-0	5	5	1200	(50)
1,1-Dichloroethene	75-35-4	5	5	1200	(50)
1,1-Dichloroethane	75-35-3	5	5	1200	(50)
1,2-Dichloroethene	540-59-0	5	5	1200	(50)
Chloroform	87-66-3	5	5	1200	(50)
1,2-Dichloroethane	107-62-2	5	5	1200	(50)
2-Butanone	78-93-3	10	10	1200	(50)
1,1,1-Trichloroethane	71-55-6	5	5	1200	(50)
Carbon Tetrachloride	56-23-5	5	5	1200	(50)
Vinyl Acetate	108-05-4	10	10	1200	(50)
Bromodichloromethane	75-27-4	5	5	1200	(50)
1,1,2,2-Tetrachloroethane	79-34-5	5	5	1200	(50)
1,2-Dichloropropane	78-87-5	5	5	1200	(50)
trans1,3-Dichloropropene	10061-02-6	5	5	1200	(50)
Trichloroethene	79-01-6	5	5	1200	(50)
Dibromochloromethane	124-48-1	5	5	1200	(50)
1,1,2-Trichloroethane	79-00-5	5	5	1200	(50)
Benzene	71-43-2	10	10	1200	(50)
cis1,3-Dichloropropene	10061-01-5	5	5	1200	(50)
2-Chloroethyl vinyl ether	110-75-8	10	10	1200	(50)
Bromoform	75-25-2	5	5	1200	(50)
2-Hexanone	591-78-6	10	10	1200	(50)
4-Methyl-2-pentanone	108-10-1	10	10	1200	(50)
Tetrachloroethene	127-18-4	5	5	1200	(50)
Toluene	108-88-3	5	5	1200	(50)
Chlorobenzene	108-90-7	5	5	1200	(50)
Ethyl benzene	100-41-4	5	5	1200	(50)
Styrene	100-42-5	5	5	1200	(50)
Xylenes (total)	1330-20-7	10	10	1200	(50)

C10299.003\TBL_B3-1.WP5\jpa

Table B3-2. Polynuclear Aromatic Hydrocarbon (PNA) List Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL)

		Quantitation Limits*			
Semivolatiles	CAS Number	Water ug/L	Low Soil ug/Kg	Med. Soil ug/Kg	On Column (ng)
Naphthalene	91-20-3	10	330	10000	(20)
Acenaphthylene	208-96-8	10	330	10000	(20)
Acenaphthene	83-32-9	10	330	10000	(20)
Fluorene	86-73-7	10	330	10000	(20)
Phenanthrene	85-01-8	10	330	10000	(20)
Anthracene	120-12-7	10	330	10000	(20)
Fluoranthene	206-44-0	10	330	10000	(20)
Pyrene	129-00-0	10	330	10000	(20)
Benzo(a)anthracene	56-55-3	10	330	10000	(20)
Chrysene	210-81-9	10	330	10000	(20)
Benzo(b)fluoranthene	205-99-2	10	330	10000	(20)
Benzo(k)fluoranthene	207-08-9	10	330	10000	(20)
Benzo(a)pyrene	50-32-8	10	330	10000	(20)
Indeno(1,2,3-cd)pyrene	193-39-5	10	330	10000	(20)
Dibenzo(a,h)anthracene	53-70-3	10	330	10000	(20)
Benzo(g,h,i)perylene	191-24-2	10	330	10000	(20)

* Quantitation limits listed for soil/sediment are based on wet weight. The quantiation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

Table B3-3. Polychlorinated Biphenol (PCB) List and Contract Required Quantitation Limits (CRQL)

Aroclors	CAS Number	Quantitation Limits Water ug/L	Soil ug/Kg	On Column (ng)
Aroclor-1016	12674-11-2	1.0	33.0	100
Aroclor-1221	11104-28-2	1.0	67.0	200
Aroclor-1232	11141-16-5	2.0	33.0	100
Aroclor-1242	53469-21-9	1.0	33.0	100
Aroclor-1248	12672-29-6	1.0	33.0	100
Aroclor-1254	11097-69-1	1.0	33.0	100
Aroclor-1260	11096-82-5	1.0	33.0	100

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher. There is no differentiation between the preparation of low and medium soil samples in this method for the analysis of Pesticides/Aroclors.

C10299.003\TBL_B3-3.WP5\jpa

Table B7-1. Project Analytical Methods.

Analyte Group	Method[1]
Volatile Organic Compounds	8240
Polynuclear Aromatic Nuclear Hydrocarbons	8310
Polychlorinated Biphenyls	8080

[1]Methods identified are described in Test Methods for Evaluating Solid Waste Physical/Chemical Methods.

C10299.003\TBL_B7-1.WP5\jpa

Table B11-1. Routine Preventative Maintenance Procedures and Schedules.

Instrument	Maintenance Procedures/Schedule	Spare Parts in Stock
Gas Chromatograph/ Mass Spectrometry (GC/MS)	1. Replace pump oil as needed 2. Change septa weekly or as often as needed 3. Change gas line dryers as needed 4. Replace electron multiplier as often as needed 5. Replace glass jet spliter as needed 6. Replace GC injector glass liner weekly or as often as needed 7. Replace GC column as needed 8. Check to ensure the gas supply is sufficent for the day's activity, and the delivery pressures are set as described in the SOP. 9. Check to ensure the pressure on the primary regulator never run below 100 psi.	1. Syringes 2. Septa 3. Various Electronic components 4. Glass jet spliter 5. GC column 6. Glass liner
Gas Chromatograph	1. Replace pump oil as needed 2. Change septa weekly or as often as needed 3. Change gas line dryers as needed 4. Replace GC injector glass liner weekly or as needed 5. Replace GC column as needed 6. Clean/Replace GC detector as needed 7. Check to ensure the gas supply is sufficent for the day's activity, and the delivery pressures are set as described in the SOP. 8. Check to ensure the pressure on the primary regulator never run below 100 psi.	1. Syringes 2. Septa 3. Detectors 4. Glass liner 5. GC column

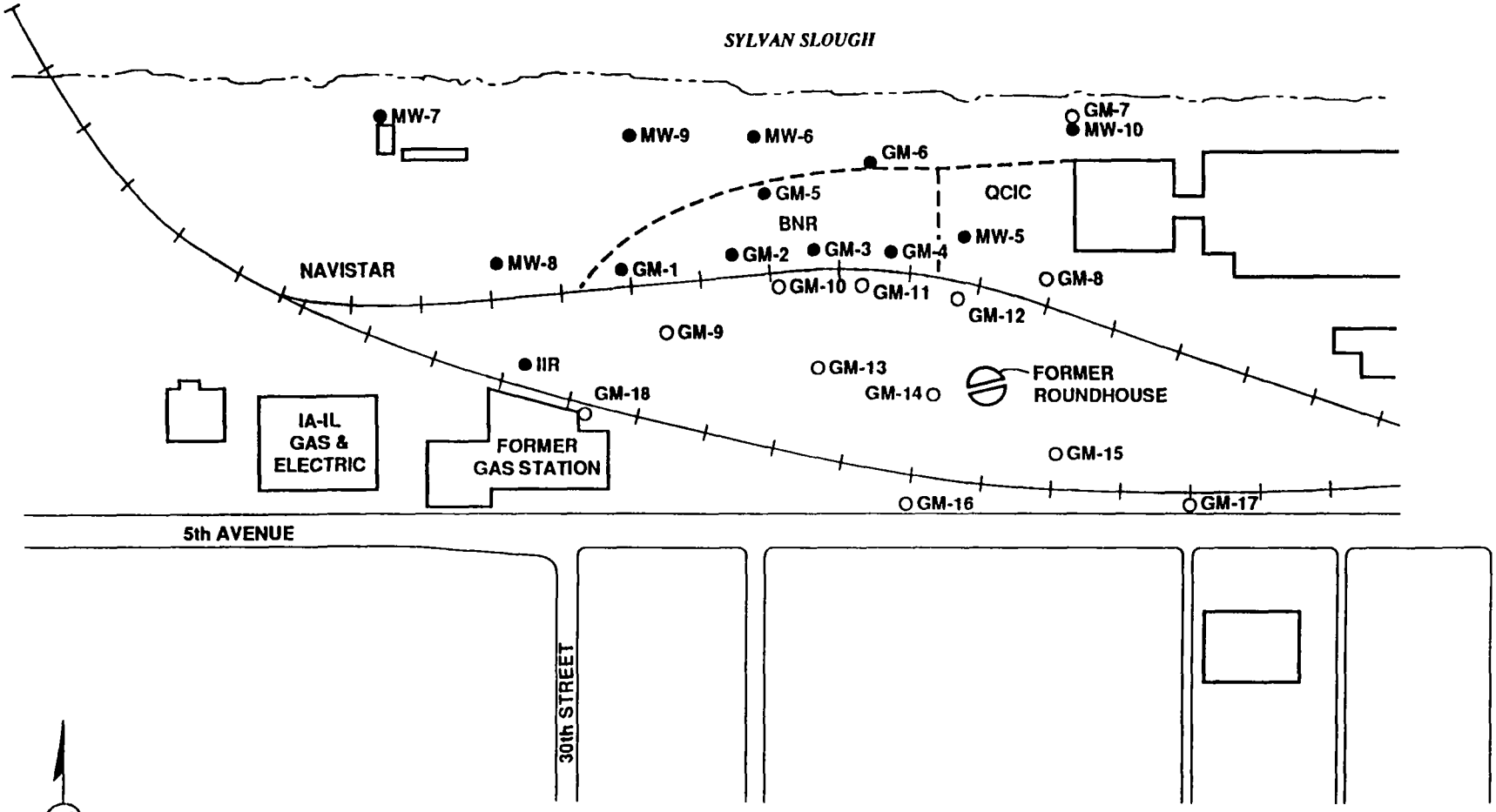
Table B11-1. Routine Preventative Maintenance Procedures and Schedules.

Instrument	Maintenance Procedures/Schedule	Spare Parts in Stock
Purge and Trap Sample concentrator	1. Replace trap as needed 2. Decontaminate the system after running high concentration samples or as required by blank analysis 3. Check system leak daily and as often as needed 4. Check to ensure the gas supply is sufficent for the day's activity, and the delivery pressures are set as described in the SOP. 5. Check to ensure the pressure on the primary regulator never run below 100 psi.	1. Spare traps 2. Spare sparger 3. Various electronic components /circuit boards 4. Plumbing supplies - tubing fitting
Technicon Autoanalyzer II	1. Inspect pump tubes after each 8-hour run; replace if discolored or distorted 2. Check to ensure the gas supply is sufficent for the day's activity, and the delivery pressures are set as described in the SOP.	1. Pump tubes

C10299.003\TBL_B11-1.WP5\jpa

FIGURES

DWG DATE: 07JUN94	PRJCT NO.: CI0299.002	FILE NO.: 1343	DRAWING: 04	CHECKED: MMM	APPROVED:	DRAFTER ELS:



LEGEND

● GM-1 EXISTING MONITORING WELL

○ GM-13 PHASE II MONITORING WELL

GERAGHTY & MILLER, INC.
Environmental Services

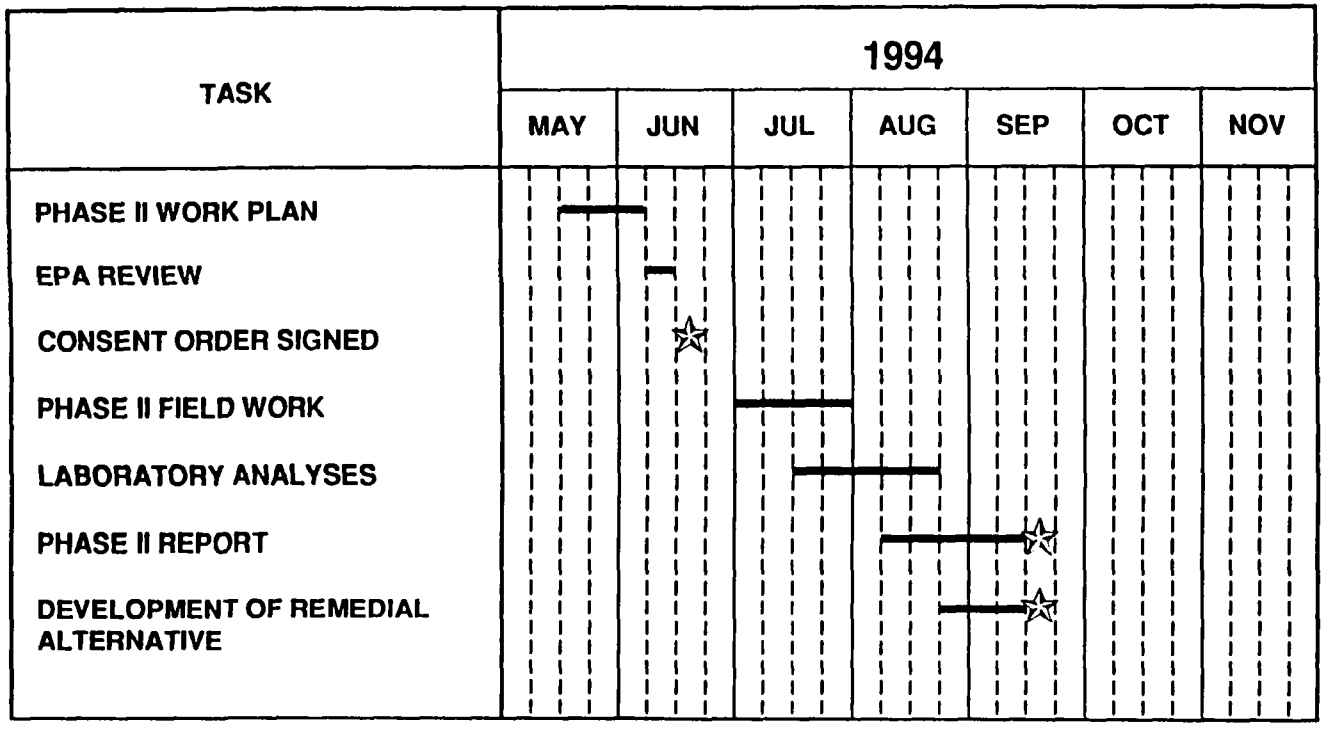
SITE MAP

PHASE II SITE INVESTIGATION WORK PLAN
NAVISTAR/BURLINGTON NORTHERN RAILROAD
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

FIGURE

B1-1

DWG DATE: 17JUN94	PRJCT NO.: CI0299.002	FILE NO.: 1340	DRAWING: 07	CHECKED: MMM	APPROVED:	DRAFTER: ELS



☆ PROJECT MILESTONE

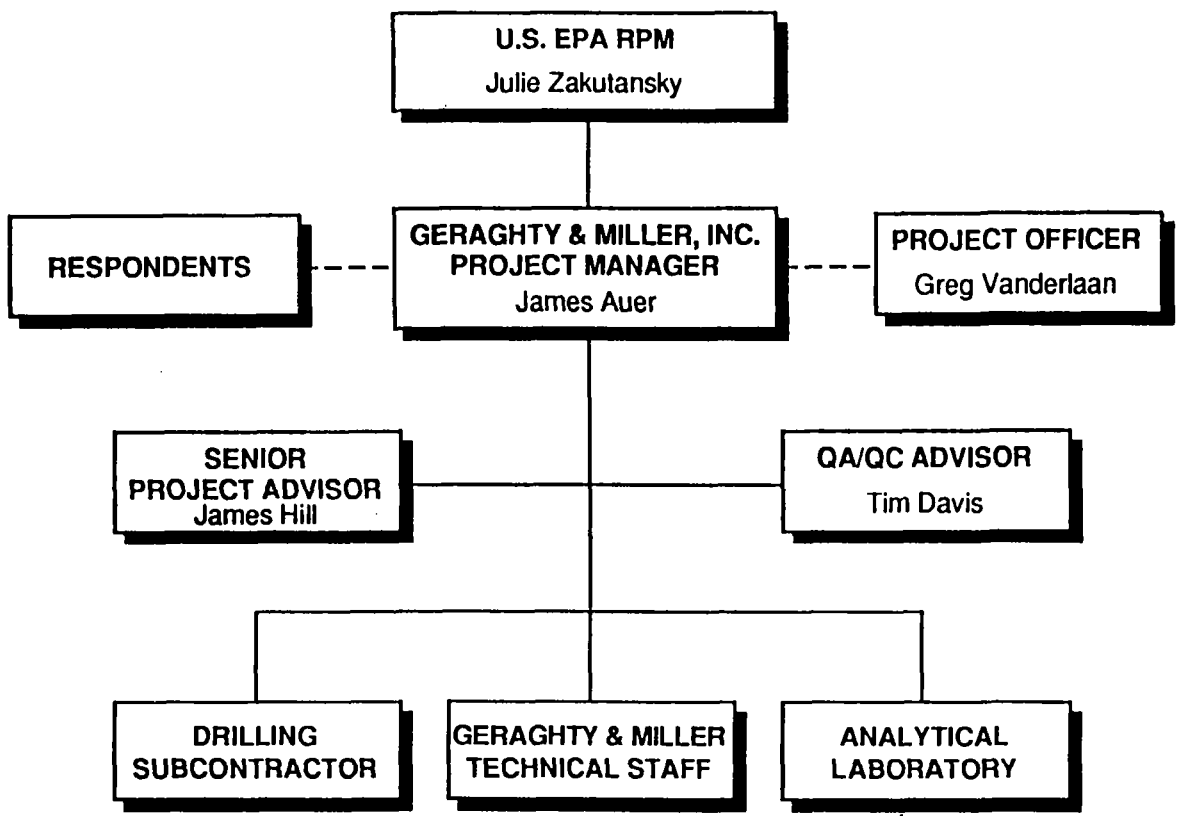
GERAGHTY & MILLER, INC.
Environmental Services

PROJECT TIMELINE

PHASE II SITE INVESTIGATION WORK PLAN
NAVISTAR/BURLINGTON NORTHERN RAILROAD
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

FIGURE
B1-2

DWG DATE: 03JUN94	PRJCT NO.: CI0299.002	FILE NO.: 1340	DRAWING: 06	CHECKED: MMM	APPROVED:	DRAFTER: ELS



GERAGHTY & MILLER, INC.
Environmental Services

PROJECT TEAM ORGANIZATION

PHASE II SITE INVESTIGATION WORK PLAN
NAVISTAR/BURLINGTON NORTHERN RAILROAD
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

FIGURE

B2-1

ATTACHMENT 1

STANDARD OPERATING PROCEDURES

VOLATILE ORGANIC COMPOUND (VOC) SOP

DUPLICATE

BY _____ DATE 6-3-94

Heritage Laboratories, Inc.
Indianapolis, Indiana
Standard Operating Procedure

~~SOP#: AM-502.0~~
Date: 01/14/94

VOLATILE ANALYSIS BY SW-846 8240A AND 8260

Submitted by: Anne Bradburn

Anne Bradburn GC/MS group leader — 1/14/94
Approval Signature and Title — Date

Gregory P. Busch - QA Office — 1-21-94
Approval Signature and Title — Date

Gary A. Klingler Lab Director — 1-24-94
Approval Signature and Title — Date

PURPOSE: This SOP describes the procedure for analysis of volatile organic compounds by purge and trap GC/MS (gas chromatograph/mass spectrometer) using SW-846 8240A and 8260. This SOP replaces MS-5.

POLICY: It is the policy of Heritage Laboratories, Inc. to have written Standard Operating Procedures for extraction and analytical procedures.

PROCEDURE:

I. Personnel - This procedure will be performed by analysts who have been properly trained by the group leader or designee. The training will be documented on the training forms (see SOP DD-501.0). Also included in the training files will be the original demonstration of ability to generate acceptable accuracy and precision.

II. Facilities - Because most common laboratory solvents are target analytes, an area free of solvent vapors is essential for the successful performance of these methods.

III. Safety - The toxicity or carcinogenicity of chemicals used in these methods have not been precisely defined; each chemical should be treated as a potential health hazard, and exposure to these chemicals should be minimized. In addition, the samples may contain other hazards not detected during this analysis such as PCBs, mercury, etc.

Laboratory coats, safety glasses, and gloves should be worn.

IV. Equipment and instrumentation -

Syringes--Various sizes may be needed but at a minimum there should be a 10 uL, 25 uL, 100 uL, and 500 uL syringe and numerous 5 mL, 10 mL, and 25 mL syringes available.

Volumetric glassware--1 mL, 2 mL and 10 mL volumetrics with ground-glass stoppers

Vials--2 mL for storage of standards and 2 dram for storage of medium level soil extracts-both with teflon-lined lids

Balance--Analytical (0.0001 g)

Purge and Trap--The purge and trap device is capable of rapidly heating the trap to 180° for desorption. Due to developments in technology, various trap packing materials are acceptable as long as the method criteria in section VII pass.

GC--The GC is temperature programmable.

MS--Capable of scanning from 35-260 amu every three seconds or less, using 70 volts electron energy and producing a mass spectrum that meets all the criteria in section VII for a 50 ng injection of BFB.

Data System--The GC/MS is connected to a data system with software which contains the NBS spectral library. It can generate TICs (total ion chromatograms) or EICP(extracted ion current profiles).

V. Materials - Commercial standards are utilized from many different sources including Accustandard, Supelco, Ultra Scientific, or Restek. All standards are prepared using purge and trap grade methanol (quickly-to avoid loss of volatiles) and stored in 2 mL vials with teflon lined screw caps at 4±2°C. Commercial stock solutions should be disposed of within one month of opening except the gases and acrolein/acrylonitrile which should be disposed of within two weeks.

The following working standard mixes are needed:

BFB (bromofluorobenzene) tune solution--to result in an injection of 50ng on column

ISTD (internal standard) mix--contains bromochloromethane, chlorobenzene-d5 and 1,4-difluorobenzene, used for calibration and the analysis of medium level soils which are spiked with surrogate during prep.

Surrogate for recalibration--contains dichlorobenzene-d4, toluene-d8, and bromofluorobenzene.

Internal standard and surrogate--containing the above six compounds.

Vol standard--containing the entire analyte list (see appendix A)- used for initial calibration, calibration check, and matrix spiking.

LCS (laboratory control sample) mix--similar to vol standard but is from separate source or lot number

Acrolein and acrylonitrile--This standard is purchased and prepared in water to minimize the degradation of acrolein.

VI. Sample requirements - Water samples should be received in glass 40 ml vials with teflon-lined septa caps. There should be no headspace present. They should be preserved with HCl to a pH < 2. The pH is checked at the time of analysis with pH paper. Soil samples should be collected in small, glass containers with teflon-lined lids. The project manager should be notified of any deviations from the proper containers or preservatives. If they advise that analysis should continue, note the discrepancy as a comment to appear on the final report.

Samples should be stored at 4±2°C until prepped for analysis. They must be analyzed within 14 days if preserved, or 7 days if not. All samples analyzed outside of holding must be commented in LIMS, even if the client sent the sample in outside of holding time.

Samples should be stored at 4±2°C for at least 60 days after analysis. Many clients require longer storage times and these should be followed. Non-hazardous waters can be poured down the sink. Hazardous samples and soils should be disposed of as required by Heritage SOP LO-12.0.

VII. Procedure -

Analysis Summary
In the purge and trap analysis, a 5 mL aqueous sample (or dilution of soil extract) is purged with helium bubbles which strip the volatile compounds out of the sample. The helium flows through a trap where the compounds are adsorbed. Larger sample volumes and/or heating the sample can be used to achieve a lower detection limit. After the purge cycle is complete, the trap is quickly heated (desorb preheat) and the flow of helium is reversed through the trap while the temperature remains elevated. During this step, the compounds are deposited on the GC column. The GC oven is heated and compounds are separated on a 1% SP 1000 on Carbopack B column or a 105 meter Restek fused silica capillary column and pass through the jet separator to the mass

spectrometer. The trap is baked out further before cooling to purge the next sample. The mass spec scans for ions with masses between 33-300 amu. Identification is made by comparing the mass spectra and retention times of sample peaks to reference spectra and retention times in a data base. Reference spectra are obtained from analysis of calibration standards under the same conditions used for analysis. Quantitation is performed using the internal standard method, comparing the response of the quantitation ion of the compound to the ion of the compound used as the internal standard. Surrogates are added to all analyses.

Tune Check

Each system used for the analysis of volatile compounds must be tuned to meet the abundance criteria listed below for a 50 ng injection of BFB.

Mass	Target value (8240A-8260)
50	15%-40%
75	30%-60%
95	100%
96	5%-9%
173	< 2% of 174
174	> 50%
175	5%-9% of 174
176	95%-101% of 174
177	5%-9% of 176

If the tune does not meet this criteria, changing the septum or axis and width calibration is all that is usually required. If these corrective actions fail, refer to the tuning SOP DD-517.0.

The system is considered in tune for 12 hours after the successful injection of BFB. Any background correction necessary to pass the criteria must be recorded in the logbook.

Accuracy and Precision

As part of training, every analyst must demonstrate the ability to generate data of acceptable accuracy and precision as described in SW-846 8240A. Analyze four replicates of a laboratory fortified blank containing each analyte of concern at a concentration of 20 ug/L. Calculate the measured concentration of each analyte, the mean concentration and the standard deviation of the measurements. Compare the average concentration and deviation with the table in Appendix B. The test can be repeated for any analytes which fail but repeated failure will be a symptom of a system problem which requires correction. All analysts must meet these criteria before starting a (new) analysis.

Initial Calibration

The system must be calibrated with a minimum of 5 concentrations. Typical concentrations are 20, 50, 100, 150 and 200 ug/L. Surrogates are calibrated as well as the target analytes. The internal standard solution is added to each calibration standard to achieve a concentration of 50 ug/L.

Relative response factors are calculated as follows:

$$RRF = \frac{\text{area (compound)}}{\text{area (ISTD)}} \times \frac{\text{concentration (ISTD)}}{\text{concentration (compound)}}$$

The percent standard deviation (% RSD) of the RRF's for each compound are also calculated and reported in the final calibration report (computer generated). The RSD must be less than 30% for those compounds identified as Calibration Check Compounds (CCC's). In addition the response factors must be greater than 0.3 for the compounds designated as System Performance Check Compounds (SPCC's).

Volatile CCC's	Volatile SPCC's
Vinyl chloride	Chloromethane
1,1-Dichloroethene	1,1-Dichloroethane
Chloroform	Bromoform (0.25)
Toluene	1,1,2,2-Tetrachloroethane
Ethyl benzene	Chlorobenzene
1,2-Dichloropropane	

Daily calibration check

A 50 uG/L calibration check is analyzed for every 12 hour sequence. The response factors of the SPCC's must meet the same criteria as for the initial calibration and the %RSD for the CCC's must be less than 25%. If any CCC's or SPCC's fail, first prepare and analyze another standard. If the CCC's still fail recalibration may be necessary. Recalibrating will not help if an SPCC fails. Instrument maintenance, including rinsing the purge and trap lines or transfer line with methanol, is usually required. (For more information on purge and trap maintenance see SOP DD-512.0.) While there are no criteria on the rest of the compounds, be alert that all compounds (especially ketones and 1,1,2,2-Tetrachloroethane) have an area high enough to maintain the detection limit.

If the retention time for any internal standard changes by more than 30 seconds, or the area of the internal standard changes by more than a factor of 2 (-50% to +100%) from the last calibration check, the system must be inspected for malfunctions and repaired. If the change does not require repair, indicate what caused the shift on the internal standard area tracking form and recalibrate as soon as possible.

The concentrations of surrogates and analytes are calculated using the RRF from the continuing calibration check and the equation:

$$\text{conc} = \frac{\text{area (compound)}}{\text{area (ISTD)}} \times \frac{\text{concentration (ISTD)}}{\text{RRF}}$$

Blanks

A blank is required after the continuing calibration and before the analysis of any samples. No target compounds should be in the blank above the detection limit except for common solvents (toluene, acetone, methylene chloride, and methyl ethyl ketone) which can be 5 times the detection limit (as in the CLP SOW). If a compound does appear in the blank, it is up to the discretion of the QA department as to whether to accept the run or reanalyze. Typically, analysis will not be accepted unless the problem can be shown to be isolated to the DI or methanol used for medium soils. Blanks containing analytes due to instrument contamination will not be accepted. If an analyte appears in a sample which was in the blank, it will be reported (flagging the results) and re-run when the blank problem is under control if the holding time allows. All possible efforts will be made to avoid reporting data flagged with "also detected in the blank".

Surrogates and Internal Standards

All standards, blanks, QC and samples must be spiked with surrogates and internal standards at a concentration of 50 uG/L in the syringe. Medium level soils are spiked with surrogate at the time of prep to give a concentration of 50 ug/L if 200 uL of methanol extract is added to the 5 mL syringe.

The internal standard areas must not vary by more than a factor of two from the continuing calibration standard or the sample must be reanalyzed. If the sample passes when reanalyzed report the reanalysis only. If it fails again report the original with a comment. (If the client requires both analyses then report both with a comment.)

The surrogates must pass the limits given below. The reanalysis strategy is the same as for failing internal standards.

	Water	Soil
1,2-Dichloroethane-d4	76-114	70-121
Toluene-d8	88-110	81-117
Bromofluorobenzene	86-115	74-121

Spikes

Analyze a matrix spike/matrix spike duplicate every run (at least one set per 20 samples). It is spiked at 50 ug/L for waters, 50 ug/Kg for low soils, and 0.32 mg/Kg for medium soils. Compare the recoveries

with those in Appendix B. If any analytes fail, an LCS is required in the run. This is at 2/5 the concentrations of the MS/MSD. Compare the recoveries of those which failed in the MS/MSD with those in Appendix B. If any fail again reanalysis of the run is required. Medium level soils are flagged as estimated if any analytes fail in both the MS/MSD and the LCS.

TICs (Tentatively Identified Compounds)

Library searches are performed when requested by the client. Typically the 10 largest, non-target analytes with a response greater than 10% of the nearest internal standard are identified. A search is performed against the NBS library and a tentative identification is made. The concentrations are calculated as targets except the total peak areas are used for the compound and internal standard (not the ion areas) and a RRF of one is assumed.

Appendix IX

When the Appendix IX analytes are requested they will be analyzed on an instrument which has been calibrated for all the compounds. If any of the Appendix IX analytes which are not routine analytes (see Appendix D) are detected the sample will be reanalyzed after a standard containing the analyte is run. The response factor from this one point calibration standard will be used to quantitate the compound.

Contamination

Possible sources of contamination include the other areas of the laboratory, where these solvents are used routinely; other samples stored in the cooler; contaminants in the DI; and contaminants in the methanol.

The lab was designed to limit contamination from other areas. Analysts switch lab coats when moving from the prep lab to the volatile analysis area.

Holding blanks are analyzed every two weeks. As one is removed another is stored in the cooler. This is used as a check for cross-contamination. Also, any highly concentrated sample is placed in a larger container and stored in the walk-in cooler. Any suspected cross-contamination is reported to the client.

The DI tap used for volatile analysis has an extra carbon filter used to remove organics. This is replaced routinely and whenever breakthrough is suspected.

Purge and trap grade methanol is used to prepare all standards and medium soil extracts.

VIII. Documentation

Logbooks

The instrument logbook must be labelled with the instrument type, id number, and serial number. The inside must contain the names of the tune files, method files, id files, and cal files. A few pages are reserved for non-routine instrument maintenance (source cleaning, column changing, etc.).

All runs should be recorded in the logbook. Included are the purge and trap position (to be used to check potential carryover), sample number, dilution factor (with the dilution amounts recorded also), and file number. Any high concentrations are recorded in the logbook also to monitor the positions for carryover.

Any other potentially useful information is recorded.

Forms

See Appendix C for examples of the forms described below:

1) Instrument maintenance forms--Used to record any instrument maintenance, the date performed, and the analyst.

2) Internal standard area tracking form--A new one is filled out for each initial calibration. The continuing calibrations are entered daily and must be within 30 seconds for retention time and within a factor of two for area.

3) BFB tune form--Indicates what sample and QC were analyzed in each twelve hour period. Includes time of analysis.

4) Internal standard area form--Used to compare samples and QC with the continuing calibration standard.

5) Surrogate recovery form--Used to record the surrogate recoveries of samples and QC.

6) Medium level soil prep sheet--Includes sample number, analyst, date, and spiking solutions.

Appendix A-Analyte List and Detection Limits (using a 5 mL sample)

Analytes	Detection Limits Waters or Low Soils (ug/L or ug/Kg)	Med Soils (mg/Kg)
Acetone	20	1.2
Acrolein	50	3.1
Acrylonitrile	70	4.4
Benzene	5	0.31
Bromodichloromethane	5	0.31
Bromoform	5	0.31
Bromomethane	10	0.63
Carbon disulfide	5	0.31
Carbon tetrachloride	5	0.31
Chlorobenzene	5	0.31
Chloroethane	10	0.63
Chloroform	5	0.31
Chloromethane	10	0.63
Dibromochloromethane	5	0.31
cis-1,3-Dichloropropene	5	0.31
Dichlorodifluoromethane	10	0.63
1,1-Dichloroethane	5	0.31
1,2-Dichloroethane	5	0.31
1,1-Dichloroethene	5	0.31
1,2-Dichloropropane	5	0.31
Ethylbenzene	5	0.31
Fluorotrichloromethane	5	0.31
2-Hexanone	10	0.63
Methylene chloride	5	0.31
Methyl ethyl ketone	10	0.63
4-Methyl-2-pentanone	10	0.63
Styrene	5	0.31
1,1,2,2-Tetrachloroethane	5	0.31
Tetrachloroethene	5	0.31
Tetrahydrofuran	25	1.5
Toluene	5	0.31
1,2-Dichloroethene(total)	5	0.31
trans-1,3-Dichloropropene	5	0.31
1,1,1-Trichloroethane	5	0.31
1,1,2-Trichloroethane	5	0.31
Trichloroethene	5	0.31
Vinyl acetate	10	0.63
Vinyl chloride	10	0.63
Xylenes (total)	5	0.31

Appendix B-QC Table

	Range for "Q" uG/L	Limit for S.D. uG/L	Range for Mean uG/L	Range for P %
Benzene	12.8-27.2	6.9	15.2-26.0	37-151
Bromoform	14.2-25.8	5.4	11.4-31.1	45-169
Carbon tetrachloride	14.6-25.4	5.2	17.2-23.5	70-140
Chlorobenzene	13.2-26.8	6.3	16.4-27.4	37-160
Chloroethane	7.6-32.4	11.4	8.4-40.4	14-230
2-Chloroethylvinyl-ether	D-44.8	25.9	D-50.4	D-305
Chloroform	13.5-26.5	6.1	13.7-24.2	51-138
Dibromochloromethane	13.5-26.5	6.1	13.8-26.6	53-149
Bromodichloromethane	13.1-26.9	6.4	10.1-26.0	35-155
1,1-Dichloroethane	14.5-25.5	5.1	14.2-28.5	59-155
1,2-Dichloroethane	13.6-26.4	6.0	14.3-27.4	49-155
1,1-Dichloroethene	10.1-29.9	9.1	3.7-42.3	D-234
1,2-Dichloropropane	6.8-33.2	13.8	3.8-36.2	D-210
trans-1,3-Dichloropropene	10.0-30.0	10.4	7.6-32.4	17-183
Ethylbenzene	11.8-28.2	7.5	17.4-26.7	37-162
Bromomethane	2.8-37.2	17.9	D-41.2	D-242
Chloromethane	D-40.8	19.8	D-45.9	D-273
Methylene Chloride	12.1-27.9	7.4	D-41.0	D-221
1,1,2,2-Tetrachloroethane	12.1-27.9	7.4	13.5-27.2	46-157
Tetrachloroethene	14.7-25.3	5.0	17.0-26.6	64-148
Toluene	14.9-25.1	4.8	16.6-26.7	47-162
trans-1,2-Dichloroethene	13.9-26.1	5.7	13.6-28.5	54-156
1,1,1-Trichloroethane	15.0-25.0	4.6	13.7-30.1	52-162
1,1,2-Trichloroethane	14.2-25.8	5.5	14.3-27.1	52-150
Trichloroethene	13.3-26.7	6.6	18.6-27.6	71-157
Trichlorofluoromethane	9.6-30.4	10.0	8.9-31.5	17-181
Vinyl Chloride	0.8-39.2	20.0	D-43.5	D-251

SOP#: AM-502.0
Date: 01/14/94
Page 11 of 17

Appendix C-Forms
1) Instrument Maintenance Form

EMS-Heritage Laboratories, Indianapolis, Indiana
Volatile Daily Maintenance - SOP#_____

Instrument ID:_____ Starting Date: _____
Column :_____

Day/ Date	Change Septum	Change Liner *	Clip Column *	/ Purge Flow	Wash Purge Vessels **	Change Column	Clean Source	Clean Quad	Replace Fuit	Other (Specify)	Analyst

** - Required Daily Maintenance * - Capillary Only / Dog and initial daily

Post near/on instrument and archive in 3-ring binder in SV area.

"Other" examples, EP Service, Changed Helium Tank, etc.

Day abbreviations: M, T, W, R, F, St, Sn Effective 3/10/92

2) Internal Standard Tracking Form

VOLATILE INTERNAL STANDARD AREA TRACKING FORM
EMS-Heritage Laboratories, Indianapolis

LAB FILE ID (STANDARD):_____ DATE/TIME ANALYZED:_____

INSTRUMENT ID:_____ COLUMN: PACKED

	IS1 (BCM)	RT	IS2 (DFB)	RT	IS3 (CBZ)	RT
Initial Cal Standard						
Upper Limit						
Lower Limit						
Date of Continuing Calibration Standards						
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

IS1 (BCM) = Bromochloromethane
IS2 (DFB) = 1,4-Difluorobenzene
IS3 (CBZ) = Chlorobenzene-d5

UPPER LIMIT = + 100% of internal standard area
LOWER LIMIT = - 50% of internal standard area

Column used to flag internal standard area values with an asterisk

page _____ of _____

3) BFB Tune Form

5A
VOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK
BROMOFLUOROBENZENE (BFB)

Lab Name: HERITAGE LABORATORIES, INC. Contract: _____

Project No.: _____ Site: _____ Location: _____ Group: _____

Lab File ID: _____ BFB Injection Date: _____

Instrument ID: GCMS#3 BFB Injection Time: _____

GC Column: PACKED ID: 2.00 (mm) Heated Purge: (Y/N) Y

m/e	ION ABUNDANCE CRITERIA	%RELATIVE ABUNDANCE
50	8.0 - 40.0% of mass 95	
75	30.0 - 66.0% of mass 95	
95	Base peak, 100% relative abundance	
96	5.0 - 9.0% of mass 95	
173	Less than 2.0% of mass 174	( )1
174	50.0 - 120.0% of mass 95	
175	4.0 - 9.0% of mass 174	( )1
176	93.0 - 101.0% of mass 174	( )1
177	5.0 - 9.0% of mass 176	( )2

1-Value is % mass 174 2-Value is % mass 176

This check applies to the following SAMPLES, MS, MSD, BLANKS and STANDARDS:

	SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01					
02					
03					
04					
05					
06					
07					
08					
09					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

Page 1 of 1

FORM V VOA 3/90

4) Internal Standard Area Form

8A
VOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: HERITAGE LABORATORIES, INC. Contract: _____

Project No.: _____ Site: _____ Location: _____ Group: _____

Lab File ID (Standard): _____ Date Analyzed: _____

Instrument ID: GCMS#3 Time Analyzed: _____

GC Column: PACKED ID: 2.00 (mm) Heated Purge: (Y/N) Y

	IS1 (BCM) AREA #	RT #	IS2 (DFB) AREA #	RT #	IS3 (CBZ) AREA #	RT #
12 HOUR STD						
UPPER LIMIT						
LOWER LIMIT						
SAMPLE NO.						
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						

IS1 (BCM) = *Bromochloromethane
IS2 (DFB) = *1,4-Difluorobenzene
IS3 (CBZ) = *Chlorobenzene-d5

AREA UPPER LIMIT = +100% of internal standard area
AREA LOWER LIMIT = -50% of internal standard area
RT UPPER LIMIT = +0.50 minutes of internal standard RT
RT LOWER LIMIT = -0.50 minutes of internal standard RT

Column used to flag values outside QC limits with an asterisk
* Values outside of QC limits.

Page 1 of 1

FORM VIII VOA

5) Surrogate Recovery Form

Lab Name: Heritage Laboratories, Inc. Contract: _____

Lab Code: EMSIN Case No.: _____ SAS No.: _____ SDG No.: _____

	EPA SAMPLE NO.	SMC1 (DCE) #	SMC2 (TOL) #	SMC3 (BFB) #	OTHER	TOT OUT
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

	QC LIMITS
SMC1 (DCE) = 1,2-Dichloroethane-d4	(76-114)
SMC2 (TOL) = Toluene-d8	(88-110)
SMC3 (BFB) = Bromofluorobenzene	(86-115)

Column to be used to flag recovery values
* Values outside of contract required QC limits
D Surrogate diluted out

page _____ of _____ FORM II VOA-1 2/88

6) Medium Soil Prep Sheet

P610.3 HERITAGE LABORATORIES, INC., INDIANAPOLIS, INDIANA

GC/MS VOLATILE SOIL EXTRACTION SHEET SHEET # 28

Run #_____ Reviewer_____ Date_____

	Sample #	Initials	Date	QC Type	Q #	Init Wt (G)	Final Vol(mL)	Surr or Spike	Blank
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
				LCS					
				SPI02					
				DSP02					

Solvent lot #_____

Appendix D-Non-routine Appendix IX Analytes

Analytes	Detection Limits Waters or Low Soils (ug/L or ug/Kg)	Med Soils (mg/Kg)
Acetonitrile	50	3.1
Chloro-butadiene	5	0.31
3-Chloropropene	20	1.2
1,2-Dibromo-3-chloropropane	10	0.63
1,2-Dibromoethane	5	0.31
trans-1,4-Dichloro-2-butene	20	1.2
1,4-Dioxane	1000	63.
Ethyl Cyanide	5	0.31
Ethyl methacrylate	5	0.31
Iodomethane	10	0.63
Isobutyl alcohol	1000	63.
Methyacrylonitrile	20	1.2
Methyl methyacrylate	5	0.31
1,1,1,2-Tetrachloroethane	5	0.31
1,2,3-Trichloropropane	5	0.31

HERITAGE LABORATORIES, Inc.

SOP Correction FORM

SOP Number: A.M. 502.0

SOP Title: Volatile Analysis by SW846-8240A and 8260.

Page #: 2

Requested by: Susan Sharp Date: 5/29/94

Correction: Section V. - HLI-Romeoville - Working standards and stock standards are both kept in the freezer at about -15°C.

Reason (if applicable): HLI-Romeoville has only one cooler - the freezer portion is used for storage of standards and the refrigerator is used for storage of samples.

Correction has been implemented (Y/N): Y Date: 5/29/94

Correction will be implemented by (date): _____

Correction will be included in next SOP revision by (date): _____

APPROVAL

Laboratory Manager Signature: Tom Carroll Date: 5/31/94

100892

HERITAGE LABORATORIES, Inc.

SOP Correction FORM

SOP Number: A.M. 502.0

SOP Title: Volatile Analysis by SW846-8240A and 8260.

Page #: 3

Requested by: Susan Sharp Date: 5/29/94

Correction: Sect. VII - HLI-Pomeroy lab uses a 75m-DB-624 column instead of a 105m Restek column.

Reason (if applicable): _____

Correction has been implemented (Y/N): Y Date: 5/29/94

Correction will be implemented by (date): _____

Correction will be included in next SOP revision by (date): _____

APPROVAL

Laboratory Manager Signature: Tom Carroll Date: 5/31/94

100892

HERITAGE LABORATORIES, Inc.

SOP Correction FORM

SOP Number: A.M.-502.0

SOP Title: Volatile Analysis by SW846-8240A and 8260.

Page #: 11

Requested by: Susan Shaw Date: 5/29/94

Correction: Appendix C - HLI-Ronaville records all instrument maintenance in a bound logbook instead of on Maintenance forms.

Reason (if applicable): _____

Correction has been implemented (Y/N): Y Date: 5/29/94

Correction will be implemented by (date): _____

Correction will be included in next SOP revision by (date): _____

APPROVAL

Laboratory Manager Signature: [signature] Date: 5/31/94

100892

POLYNUCLEAR AROMATIC HYDROCARBON (PNA) SOP

SOP Outline

EMS Test Codes: 630.0
Method Quote: EPA 8310

PNA HPLC Analysis

Referenced Procedures - EPA 8310, NIOSH 5506

I. INTRODUCTION

This method is capable of analyzing the following compounds:

Acenaphthene	Benzo(ghi)perylene	Indeno(1,2,3-cd) Pyrene
Acenaphthylene	Benzo(a)pyrene	Naphthalene
Anthracene	Chrysene	Phenanthrene
Benzo(a)anthracene	Dibenzo(a,h)anthracene	Pyrene
Benzo(b)Fluoranthene	Fluoranthene	
Benzo(k)Fluoranthene	Fluorene	

This is an HPLC method using a Supelcosil LC-PAH 5 micron reversed phase column, with UV & Fluorescence detectors. The mobile phase is a water/acetonitrile gradient at 1.2 ml/min, and the column is maintained at 30°C with a column heater. Prior to the use of this method, appropriate sample extraction must be performed.

TABLE 1
HIGH PERFORMANCE LIQUID CHROMATOGRAPHY OF PAHs

Compound	Retention time (min)	Column capacity factor (k')	Method Detection limit (ug/L) UV	Fluorescence
Naphthalene	13.00	12.2	.13	
Acenaphthylene	15.08	13.7	.20	
Acenaphthene	16.75	15.2	.13	
Fluorene	17.32	15.8		0.015
Phenanthrene	18.38	16.6	.13	
Anthracene	19.15	17.6		.017
Fluoranthrene	20.14	18.5		.017
Pyrene	20.82	19.1		.060
Benzo(a)anthracene	23.10	21.6	.34	
Chrysene	23.38	22.2		.033
Benzo(b)fluoranthene	25.51	24.0		.023
Benzo(k)fluoranthene	26.19	25.1		.010
Benzo(a)pyrene	26.84	25.9		.24
Dibenzo(a,h)anthracene	28.28	27.4		0.068
Benzo(ghi)perylene	28.99	27.8		.11
Indeno(1,2,3-cd)pyrene	29.41	28.7		.022

HPLC Conditions: Reverse phase Supelcosil PAH C-18, 5 micron particle size, 15 cm by 4.6 mm stainless steel column. Mobile phase A-35:65(v/v) Acetonitrile/water; mobile phase B-acetonitrile. Gradient - 100% A to 100% B over 40 minutes, then back to 100% A, for a total analysis time of 70 minutes.

The test code for this analysis is 630.0, and the prep code is P 238.1 [for liquids (SPE)] or P236.1 [for solids (sonication)].

Samples should be submitted in 1 liter amber borosilicate bottles with a teflon-lined cap, and should not be preserved. It is important that the sample be protected from

UV light because of possible PAH degradation. The samples must be iced or refrigerated at 4°C from the time of collection until extraction, which should be performed as soon as possible. A 40 day maximum extract storage time is recommended, because the sample stability is unknown.

INSTRUMENT DETECTION LIMIT
PNA'S
by HPLC

Date of Run: 7/7/90
Instrument: HPLC UV/Fluorescence
Column: Supelco C-18 R.P. PAH
Run: #75

ANALYTE	*IDL mg/L
Naphthalene	0.016
Acenaphthylene	0.025
Acenaphthene	0.016
Fluorene	0.0019
Phenanthrene	0.016
Anthracene	0.0021
Fluoranthene	0.0021
Pyrene	0.0075
Benzo(a)anthracene	.043
Chrysene	.0041
Benzo(b)fluoranthene	.0029
Benzo(k)fluoranthene	.0013
Benzo(a)pyrene	.030
Dibenz(a,h)anthracene	.0085
Benzo(g,h,i)perylene	0.014
Indeno(1,2,3-cd)pyrene	0.0028

*Sample detection limits are highly matrix-dependent. To calculate sample d.L.'s:

IDL x Final Volume & convert to mg/Kg or µg/L
initial wt. or Vol

II. EXTRACTION PROCEDURES

A. Theory: PNA's, whether being analyzed in water, soil/sediment, sludge, or waste, are more soluble in organic phases than aqueous phases. The samples, therefore, are extracted with an appropriate solvent either by SPE, liquid-liquid extraction, soxhlet extraction, or sonication extraction, then dried, concentrated, and exchanged into a solvent compatible with further analysis.

For soxhlet extraction refer to method 3540. For sonication extraction refer to method 3550 or the EMS SOP on sonication extractions. All soil should also undergo GPC cleanup (3640). For liquid/liquid extraction procedure refer to method 3510 or the EMS CLP protocol. This should be used when specified by client or when too much particulate material is present in the water matrix for SPE.

B. Apparatus (for solid phase extraction of water samples): The Supelco Manifold (or Equivalent), C18 cartridges (6 ml), reservoirs and adapters, 500 µl syringe, 25 µl syringe, metal guide tubes, a vacuum source, 2 ml volumetrics, 250 ml graduated cylinders, and a prep book to record information.

C. Reagents: Acetonitrile, Methylene Chloride, Millipore water, methanol.

D. Procedure

1. Wash each C18 cartridge with 1 volume each of the following solvents: ACN, MeOH, then Milli-Q water, letting the cartridge drain after each

organic wash. Then stop the water from draining through - the cartridge should not be dry.

2. Rinse the adapters and glassware with ACN, MeOH, then milli-Q water, also.

3. Measure 250 ml of homogenized sample into a graduated cylinder. Add 12 ml MeOH to each volume of water. For the prep blank use mill-Q water and the MeOH, then for the prep std, MS, and MSD, add 20 µl H-257 (or equivalent) and the 12ml MeOH. Add ISTD if appropriate.

4. If particulate material is observed in the samples, add some pre-washed glass wool to the reservoir prior to pulling the sample through. Use the glass wool in your blank and std if you use it in your samples.

5. Attach the prepared C18 cartridge and 75 ml reservoirs with adapters on the extractor (make sure metal guides are removed from the inside of the unit). Connect the vacuum source to the manifold and adjust the vacuum to 8-10 mm Hg. Draw the entire sample through the cartridge. The rate at which samples are pulled through the columns is very critical and greatly affects the recovery rate! Try to pull samples through at approximately 1 drip every second — the slower, the better.

6. Wash the cartridge with 10 ml milli-Q water. Continue to draw vacuum through the cartridge for an additional 20 minutes to dry the cartridge. Release the vacuum and discard sample to waste.

7. Centrifuge SPE tubes for 10 mins.

8. Replace the metal guide tubes on the bottom of the manifold and place the 2 ml volumetrics (pre-rinsed 3 x's with ACN) into the manifold. Make sure they are pre labelled with ID.

9. Elute the sample from the cartridge with 3 x 500 µl aliquots of ACN and 1 x 500 µl aliquot of $MeCl_2$ using a 500 µl syringe.

Note: Release the vacuum for 5 minutes after the addition of each solvent to allow the solvent to soak. Then use the vacuum to extract the solvent and allow the cartridges to dry before the next addition of solvent.

Bring to a F.V. of 2 ml with ACN

10. Filter the extracts with a 0.45 µ disposable filter using a 2.5 ml syringe. Transfer 1 ml to an ASV and label. Store the remaining portion in a labelled screw top 2 ml vial and refrigerate at 40°C.

11. If a special DL is required for a specific client, initial and FV's can be adjusted to improve elution of the PNA's.

12. Make sure all documentation is completed.

III. ANALYSIS PROCEDURE

A. Theory: Once an extracted sample is injected into the column, separation of the compounds occurs. The separated compounds then flow through the detectors.

The photodiode array detector is an ultra violet/visible detector that simultaneously measures absorbance values from 190 to 880 nanometers.

Because the data is gathered simultaneously at various wavelengths, it is possible to detect all UV absorbing components in a complex mixture. The fluorescence detector uses wavelengths that are set by the user. The NIOSH method uses 2 specific ones: the first is the wavelength at which excitation of the molecule occurs, and the second is where emission is detected. Programmed fluorescence detection uses different sets of wavelengths for excitation and emission.

B. Method: The mobile phase should be made up of two parts in order to create the gradient. The first part (Part A) should be made by making a mixture of 35% HPLC grade acetonitrile and 65% HPLC grade water (milli-Q if available). The second part (Part B) should be 100 % HPLC grade acetonitrile. Sparge both Part A and Part B at 100 ml/min with helium for at least 30 minutes immediately prior to use. In order to sparge, the lines that Part A and Part B are in must be enabled. On the pump screen, press the SETUP key. At the top of the screen will be the different reservoirs that can be enabled. To enable them, press " 1 enter". If you want to disable them, press "0 enter". For example if you have Parts A and B in lines A and C, press "1 enter", "0 enter", "1 enter", "0 enter". To start the sparge, press the "isocratic" key and arrow down to where "sparge:off" is. Key in "100 enter" where the "Off" is, and the sparge will be started.

The column required for analysis is a 15 cm x 4.6. mm 5μ (Supelcosil LC-PAH or equivalent) column. A pre-column should be attached to protect the column.

Turn on the fluorescent and DAD lamps. (Record the lamp hours of the fluorescence detector in the instrument log). Once the column has been chosen, the pump is ready to be turned on and the lines purged. First, reduce the sparge to 10 ml/min. Put the flow through 100% of the line you have Part A in. Then open the reference valve and increase the flow to 10 ml/min.

Introduce a syringe into the solvent draw off valve, open the valve, and pull approximately 10 ml into the syringe. Discard the solvent into waste collection. Repeat the pull once more, and then push about 4 ml of the solvent back through by pushing the syringe plunger back in. Close off the solvent draw-off valve and take the flow back down to 0 ml/min. Shut the reference valve. Repeat this purge with 100% flow through the line you have Part B in. Attach the pre-column to the solvent inlet line making sure the flow arrow is pointed in the right direction. Then attach the column to the pre-column, again making sure the flow will be going in the direction indicated by the arrow on the column. Set the flow for 100% of Part A, at 0.5 ml/min, and watch the outlet end of the column to check for air bubbles. Once there are no more bubbles coming out, set the flow to zero and attach the outlet end of the column. Start the flow at 0.2 ml/min and check for solvent leaking at the connections with a dry paper towel. If there are leaks, tighten the fittings. Close the top of the column heater. Turn on the column heater and wait for it to say "OFF". The press "Set 30.0 Enter". The heater will start to heat the column. While the column is equilibrating to the solvent and the lamps are warming up, the method can be set up on the computer. Go into "Powerline Control" then "Multi Method Edit". The method name is "NEWPNA". The 990 (DAD) file is "PAH", and the 600 E (pump) file is "PAN".

The DAD will measure absorbancies at 220 nm and 254 nm. NIOSH conditions call for the fluorescence detector to be set at 340 nm (excitation) and 425 nm (emission). For lower detection limits based on the fluorescence data, the fluorescence detector can be programmed as follows:

PRGM Mode T Off	GAIN: 10
EX 280 EM 333	ATTN: 1
PRGM STP 1 T 18.3	GAIN: 100
EX 340 EM 425	ATT: 1

PRGM STP 2 T 22.7 EX 265 EM 360	GAIN: 100 ATTN: 1
PRGM STP 3 T24.7 EX 340 EM 425	GAIN: 100 ATTN: 1
PRGM STP 4 T 29.1 EX 305 EM 500	GAIN: 100 ATTN: 1

The times (STP) may need to be altered a small amount to achieve appropriate timing for the change, so adjust as necessary. (You may want to check a recent PNA run, or inject a standard to just observe the fluorescence chromatography.

Once the lamps and column heater have all been equilibrated for about one hour, a few checks of the system should be made before the run is started. Turn on the auto sampler and printer, if they aren't already on. The "Select" button on the printer has to be lit in order to print. If it's not lit, push the "select" button and it should come on.

Watch the pressure reading. It will vary about 10-20 psi, but if it drops by 50 psi or jumps around instead of maintaining a somewhat consistent pressure, there is probably still air in the lines. If there is a possibility of air, purge the line again as in paragraph 4 of the method. (Record pressure in psi after stabilization in the instrument log book.) If there is no pressure, check for leaks in the column and pre-column fittings.

Make sure the components are all on and recognized by the pump: On the pump screen, push the "Setup" Key. Then push the blank white key beneath "SYSTEM CONFIG". Next, push the blank white key beneath "RESCAN". The system will be rescanned for components that were turned on after the pump and will now recognize them during the run.

20 Micro liters are injected and the run time is 70 minutes. Place the sample vials in the auto sampler tray and write the sequence in the HPLC sequence log. Program the method for the injections you want to make, and save the method. Then go into "Run Start" and push the return key to start the run. The order for injections should be as follows:

- ACN Blank
- Cal Std's L-0 thru L-4
- Extracted blank and ext. Std
- 3 samples
- Medium level cal. std. (then continue 4 samples followed by Cal Std until you get to spikes).
- Spike and duplicate spike
- Medium level cal. std.
- N.I.S.T. Std

IV. QUALITY ASSURANCE/QUALITY CONTROL

A. At least one prep blank is prepared in 20 samples or per batch, which ever is more frequent.

B. At least one extracted standard is prepared in 20 samples or per batch, according to client contracts.

C. At least one matrix spike and duplicate matrix spike will be prepared in 20 samples or per batch according to client contracts.

D. QC Limits: Blanks should be non-detected. Recoveries (table). % RSD should be ≤ 20 for at least 80% of the compounds. % deviation should be < 20 for continuing Cal std's.

Linearity should be within 20%, otherwise, a single point calibration should be used. The fluorescence detector would be a better candidate for the single-point calibration.

CALCULATIONS

Calculations are best done on prepared sheets. Five levels of calibration standards are run at the beginning of each run to determine response factors with which samples will be calculated. Begin calculations with the lowest level standard injection, then continue through the chromatogram. Label the chromatogram with the identity of the peaks and their corresponding concentrations by using a similar run to compare chromatography. Using a prepared calculating sheet, fill in the retention times and heights for each analyte. Calculate a response factor for each analyte by dividing the concentration by peak height. Do this for each of the five levels of calibration standard. Average the 5 response factors for each analyte and record the results on a Response Factor Summary Sheet.

The % linearity needs to be calculated as well. Enter the 5 response factors into the standard deviation (statistics) mode of a calculator. Use the same mode to find standard deviation. Then divide the std. dev. by the average of the 5 response factors and multiply by 100%. Record the % linearity for each analyte on the Response Factor Sum. Sheet.

Sample calculations are next. There will be at least one prep blank, prep standard, matrix spike, and matrix spike duplicate along with the samples. Start by calculating the retention time windows for each analyte. The RT window is +/- 0.5% of the analyte RT for the medium cal. std. Record the window retention times on your response factor summary sheet on the side. For each chromatogram, check all integrated peaks to see if the RT falls within any window of the PNA analytes.

If any of the peaks do fall within any given window (excluding STD, MS, or MSD) a spectrum will have to be drawn by the computer to compare it to the standard spectrum. If the spectra match, the analyte is confirmed and its RT and peak height are recorded on the calculating sheet. The name of the analyte is then written above the peak on the integrated chromatogram to identify it, and the spectrum plot of the individual peak is labelled with the analyte's name (i.e., 'Naphthalene confirmed).

If no analytes are found to match windows or spectrum plots, then ND/BDL is recorded on the calculating sheet for each analyte.

The prep STD, MS and MSD do not need to be confirmed with a spectrum plot, but the chromatogram needs to be labelled and the peak heights and retention times need to be recorded on the calculating sheet. Make sure that all of the expected analytes are present.

For each prepped sample (including the prep STD, MS, MSD) with detected analytes, find the corresponding average response factor from the beginning Cal Std's, and record it on the calculating sheets above peak heights. Multiply the peak height by the RF to get an extract concentration for each analyte and record it on the calculating sheet.

In between groups of sample injections and at the end of the run are medium level Cal std's. For these, use the standards calculating sheets, record the RT and peak heights for each analyte and calculate response factors. Check the deviation of that response factor from the average RF of the beginning Cal std's by subtracting the response facator from the average RF and dividing that difference by the average RF of the Cal std's, and multiplying the result by 100%:

$$\frac{|RF - \text{Average RF}|}{\text{Ave. R.F.}} \times 100\% = \%\ D$$

Record the % D on the side of the standard calculating sheet. For the ending standard, the % D should be recorded on the Response Factor Summary Sheet.

To calculate the final result for the concentration of detected analytes in samples, MS, MSD, and prep std., the extract concentration is multiplied by the final volume (FV) of the sample prep, divided by the initial volume (IV) and converted to units of µg/L. Dilutions or concentrations are taken into the calculation the same way. For example, if a 250 ml sample is taken to 2 ml, then diluted 1ml → 5ml, then calculate as follows:

$$\text{extract conc.} \left(\frac{\text{mg}}{\text{L}}\right) \times \frac{2\text{ ml}}{250\text{ml}} \times \frac{5\text{ml}}{1\text{ ml}} \times \frac{1000\ \mu\text{g}}{1\text{ mg}} = \text{final result } (\mu\text{g/L})$$

The final result is recorded on the calculating sheet.

For the prep. std, MS, and MSD you need to calculate a true value of each analyte by two steps. First, multiply the amount of spiking solution used by the concentration of the analyte in that solution, and divide by the prepped final volume. This gives the true ext. conc. Then multiply the true ext. conc. by the final volume and divide by initial volume. This value needs to be converted to units of µg/L. Calculate the recoveries of the prep. std, MS and MSD by dividing final result by true value and multiplying the result by 100%. Replicability is calculated for the MS and MSD by finding the difference of their final results, multiplying that by 2, and dividing that value by the sum of the MS and MSD final results and that value multiplied by 100%:

$$\frac{2 \times |\text{(difference of final results}|}{\text{(MS final result + MSD final Result)}} \times 100\% = \%\ \text{Replicability}$$

Record the appropriate values on the extracted standard/MS/MSD Recovery Form.

VI. INTERFERENCES/TROUBLE SHOOTING

Matrix interferences may be introduced from the sample. If the plot goes completely off-scale due to interference or is unreasonable to integrate, dilutions of the previously injected sample may be necessary. If these dilutions are made, they must be included in the calculations and detection limits altered accordingly (i.e., if diluted by a factor of 5, the detection limits need to be multiplied by 5).

Occasionally, the retention time of a suspected analyte is not quite within the window, or is noticeably outside of the window, but the spectrum plot matches exactly. In this case, an alkylated version of the analyte may be present and should be calculated and noted as such.

Sometimes matrix interference can cause a considerable shift in retention time. If the interference is especially bad, and there is a suspected analyte, dilute the sample and check again for the analyte. A spike 01 should be analyzed to confirm the retention time shift.

There sometimes is a peak that falls within the window, yet only one or two of the traces on the spectrum plot matches. This may indicate an impure peak and should be calculated and noted as such.

VII. SAFETY PRECAUTIONS

Because the toxicity and carcinogenicity of each analyte and reagent in this method have not been precisely defined, each should be treated as a potential health hazard. Safety glasses, gloves and a lab coat should be worn when working through this method. Benzo(a) pyrene, however, is definitely a suspect carcinogen.

III. CLEAN-UP AND DISPOSAL

Water samples, if non-detected, can be disposed of down the drain with copious amounts of water. All extracts, standards and mobile phase waste must be submitted to HR/E for disposal.

If clean-up of an area is needed, an aqueous detergent is recommended. Then the area should be rinsed with water followed by methanol.

EMS
PNA-HPLC
RESPONSE FACTOR SUMMARY SHEET
CALIBRATION

Wavelength	Analyte	L-0	L-1	L-2	L-3	L-4	$\bar{x}$5	% Linearity	%D CCAL
	Dibenz(c,g)carbazole								
	Dibenz(a,i)pyrene								
	Benzo(j)fluoranthene								
	Dibenz(a,j)acridine								
	Dibenz(a,h)acridine								
	3-Methyl Cholanthrene								
	Dibenz(a,e)pyrene								
	Dibenze(a,h)pyrene								

COMMENTS:_____

EMS HERITAGE LABORATORIES, INDIANAPOLIS, INDIANA 46231

- 8310 HPLC/Fluorescence/DAD

_____ Customer Description_____ DT3File#_____

_____/_____ Calculator_____ GPC_____

tor_____ Units_____ Other_____

_____ Initial Wt. or Volume_____

on Time Fluor	Analyte	Spectral Confirmation	RF Height 220	254	Fluor	Result 220	254	Result Fluor	Final Result	D.L.
	Dibenz(c,g)carbazole									
	Dibenz(a,i)pyrene									
	Benzo(j)fluoranthene									
	Dibenz(a,j)acridine									
	Dibenz(a,h)acridine									
	3-Methyl Cholanthrene									
	Dibenz(a,e)pyrene									
	Dibenz(a,h)pyrene									

f _____ Reviewed by_____

Date_____

POLYCHLORINATED BIPHENYL (PCB) SOP

DO NOT DUPLICATE

THIS IS AN EXACT COPY OF THE ORIGINAL DOCUMENT.

BY NCH DATE 4-26-94

Heritage Laboratories, Inc.
Indianapolis, Indiana
Standard Operating Procedure

SOP#: AM406.0
Date: 02/24/94

PCB/PESTICIDE WATER LIQUID/LIQUID EXTRACTIONS

Submitted by: Lisa A. Julian

Lisa A. Julian GC Group Supervisor — 3-7-94
Approval Signature and Title — Date

Gregory A. Black, QA Officer — 3-9-94
Approval Signature and Title — Date

Gary A. Klingler, Laboratory Director — 3-14-94
Approval Signature and Title — Date

PURPOSE:

The purpose of this SOP is to standardize the process for the extraction of PCBs and Pesticides from water and liquid samples in preparation for analysis by electron capture gas chromatography. The referenced method for this SOP is SW846-3510.

POLICY:

It is the policy of Heritage Laboratories, Inc. to provide Standard Operating Procedures in writing setting forth practices and procedures that management is satisfied are necessary and adequate to insure the quality and integrity of laboratory operations for all sample extractions.

PROCEDURE:

I. PERSONNEL

All Laboratory analysts involved in the analysis of samples by this method must be trained. Training will be documented on group training forms by the group leader or designee. The group leader is responsible for ensuring that the method is available to the analysts and that all QC criteria are met (data review). The QC department is responsible for ensuring that method requirements for IDL and MDL are met before the test is certified for use.

II. SAFETY

Standard laboratory safety precautions are necessary, including wearing safety glasses, lab coats and gloves when working with samples and/or standards in the lab.

III. EQUIPMENT AND INSTRUMENTATION

1000 mL Graduated cylinder
2000 mL Separatory funnel with teflon stopcocks and stoppers
Kuderna-Danish (KD) evaporative concentrator:
    10 mL concentrating ampule, 500 mL KD evaporating flask, 3 ball macro-Snyder column, and 2 ball micro-Snyder column
Glass Moonie funnel - 20 mm
Hot water bath
10 mL volumetric flasks
Volumetric pipets - various sizes
Disposable pasteur pipets
Autosampler vials
2 dram vials
Vaccuum manifold
Boiling chips
Alkacid - pH test paper
glass wool
100 mL graduated cylinder
Teflon stirring rods (in case of emulsions)

IV. MATERIALS

Methylene chloride - optima grade
Hexane - optima grade
Sodium sulfate - Baked at 400 °C overnight
Surrogate solution - 0.50 mg/L Tetrachloro-m-xylene and 0.50 mg/L Decachlorobiphenyl in acetone (or methanol)
Spiking Solution - standard mix containing the following:

gamma-BHC	0.50 mg/L	Dieldrin	1.00 mg/L
Heptachlor	0.50 mg/L	Endrin	1.00 mg/L
Aldrin	0.50 mg/L	4,4'-DDT	1.00 mg/L

10 N Sodium hydroxide
1+1 Sulfuric acid
Florisil LSE cartridges

V. SAMPLE REQUIREMENTS

All samples should be received in liter amber glass containers with a teflon lined screw top lid. The samples should be kept refrigerated at 4 °C until extraction. Samples from chlorinated sources should be preserved with Sodium Thiosulfate. Samples must be extracted within 7 days of

collection. Sample extracts must be refrigerated at 4 °C until analysis and must be analyzed within 40 days of extraction.

Samples and sample extracts are retained for at least 30 days after final report generation. After 30 days, samples are disposed of according to waste characteristics.

VI. QA/QC REQUIREMENTS

One blank (BLA02) must be prepared at a frequency of 10% of the samples. The blank is prepared by extracting a 1000 mL aliquot of the laboratory DI water in the same manner as the samples.

One standard (LCS) must be prepared at a frequency of 10% of the samples. The standard is prepared by spiking a 1000 mL aliquot of the laboratory DI water with 1.0 mL of the spiking solution and extracting in the same manner as the samples. Other aroclors or concentrations may be substituted if required.

A matrix spike (SPI02) and a matrix spike duplicate (DPS02) should be prepared at a frequency of 10% of the samples. The spikes are prepared by spiking a 1000 mL aliquot of the sample with 1.0 mL of the spiking solution. The matrix spike and matrix spike duplicate are then extracted in the same manner as the samples.

VII. PROCEDURE

All glassware should be cleaned with hot soapy (Microsoap) water, rinsed with tap water, distilled water and a final rinse with acetone. Before using the separatory funnel and KD apparatus, solvent rinse three times with methylene chloride.

Check the pH of the sample using alkacid paper to assure it is between a pH of 5 and 9. Adjust the pH with 10 N sodium hydroxide or 1+1 sulfuric acid if necessary. When using the entire sample for analysis, mark the level of the sample in the bottle so the sample volume can be determined at a later time. If only a portion of the sample is to be analyzed, measure out the desired amount in a clean, methylene chloride rinsed graduated cylinder. Record the volume of sample analyzed on the prep bench sheet.

Quantitatively transfer the sample to a 2000 mL separatory funnel. If the sample volume used is less than 600 mL, a 1000 mL (or smaller) separatory funnel may be used. Place the funnel in a ring stand. Add 1 mL of the water surrogate to

the sample in the separatory funnel. Rinse the sample jar (or graduated cylinder used to measure out the sample) with 100 mL of methylene chloride and add the rinse to the separatory funnel. If the entire sample was used, fill the empty sample bottle with water to the liquid paper mark. Pour the water into a graduated cylinder and record the volume on the prep sheet.

Vigorously shake the separatory funnel for two minutes, venting the funnel to release pressure as needed. Place the funnel back into the ring stand and allow the methylene chloride and water layers to separate for about 5 minutes. If an emulsion forms, the emulsion must be broken up before continuing. Refer to Appendix A for methods of breaking emulsions.

Assemble a KD concentrator by attaching a 10 mL concentrating ampule to a 500 mL KD flask. Plug a glass moonie funnel with glass wool and place it on top of the KD apparatus. Pour about 3 to 4 grams of sodium sulfate into the funnel. Methylene chloride rinse the sodium sulfate in the funnel. Drain the methylene chloride (bottom layer) from the separatory funnel through the sodium sulfate. The funnel with sodium sulfate acts as a drying column to retain any water included with the methylene chloride. Add 50 mL of methylene chloride to the separatory funnel and extract in the same manner, again draining the methylene chloride layer into the KD flask. Perform a third extraction in the same manner as the second.

Rinse the sodium sulfate with approximately 30 mL of methylene chloride followed by about 30 mL of hexane. Swirl the KD flask to mix the hexane with the methylene chloride extracts. Add two or three boiling chips to the KD flask. Rinse a three ball macro-Snyder column with hexane and attach to the top of the KD apparatus. Concentrate the extracts by evaporating the solvent on a hot water bath. Place the tip of the concentrating ampule into a boiling water bath. Tap the KD apparatus gently until the solvent begins to boil and the balls begin to "chatter", then lower the KD until the boiling water is at about the level of the 10 mL mark on the concentrating ampule. Concentrate the extract to between 2 and 4 mL and remove from the bath. Rinse the macro-Snyder column with hexane and allow to drain and cool. Remove the concentrating ampule from the KD flask and rinse the ground glass joint with hexane into the ampule. Rinse a 2 ball micro-Snyder column with hexane and attach to the ampule. Place the tip of the ampule back in the boiling water bath, tapping the ampule gently until the solvent begins to boil and the balls begin to "chatter". Concentrate the extract to 1 mL

and remove from the bath. Rinse the micro-Snyder column with a few drops of hexane, allow to drain and cool. Remove the micro-Snyder column from the ampule, rinsing the ground glass joint with hexane into the ampule.

The sample extract must be cleaned-up using the florisil cartridge clean-up procedure. After florisil clean-up, bring the sample extract to a final volume of 10.0 mL in a volumetric flask. Transfer approximately 1 mL of the extract to an autosampler vial for analysis by GC/ECD. Transfer the remainder of the sample extract to a 2 dram vial for storage.

VIII. DOCUMENTATION

All sample prep data is recorded on a Prep Sheet, refer to the Appendix B for a sample prep sheet. The prep sheet is used to record the sample number along with the test code, extraction analyst, date extracted, initial volume, final volume, dilutions required, surrogate added and spike information. Any sample comments relating to the extraction should also be recorded on the Prep Sheet.

Prep Sheets are maintained in ring bound notebooks. Once prep sheets are filled, they are maintained in the ring bound notebook for at least one month and are then transferred to binders for storage on site for a minimum of six months, after that six month period, the binders are archived off site.

IX. REPORTING

After review of the prep run by the group leader (or designee), the Prep Sheets will be given to the Data Entry Group for sample result entry into the LIMS data base.

APPENDIX A

Procedure for Breaking Emulsions

If the emulsion interface between layers is more than one-third the size of the solvent layer, the analyst must employ mechanical techniques to complete the phase separation. The optimum technique depends upon the sample and may include stirring, filtration of the emulsion through glass wool, centrifugation, or other physical methods.

Emulsion Breakers

1. Use a 9" disposable pipet, or solvent rinsed teflon stirring rod, to stir the emulsion. This will break up most of the emulsion so that 75% of the solvent can be drained.

If stirring does not break up the emulsion then any of the following methods could be tried.

2. Fill a funnel with solvent rinsed glass wool. Slowly drain the emulsion through the funnel into a flask. If the emulsion does not flow through easily, stir contents and glass wool with a teflon stirring rod. Rinse the glass wool with methylene chloride and squeeze the excess with the tongue blade. Usually this separates the emulsion into two layers (water and methylene chloride). Pour the contents of the flask back into the separatory funnel carefully, and allow the layers to separate. Drain the methylene chloride layer into the KD flask.

3. Drain the emulsion into a 25 mL beaker which contains approximately one inch of anhydrous sodium sulfate. Break up the sodium sulfate with a glass stirring rod, and carefully pour the contents of the beaker back into the separatory funnel and allow the layers to separate. Rinse the sodium sulfate in the beaker with methylene chloride and pour the rinse into the KD flask. Drain off the methylene chloride layer in the separatory funnel into the KD flask.

4. If none of these methods will break the emulsion, drain the lower layer into a small (250 mL) separatory funnel and add about 2 mL sulfuric acid to break the emulsion. Drain only the methylene chloride into the KD apparatus. Discard the water layer.

APPENDIX B

Sample Prep Sheet

HERITAGE LABORATORIES, Inc.

SOP Correction FORM

SOP Number: AM 406.0

SOP Title: PCB/PESTICIDE LIQUID/LIQUID EXTRACTIONS

Page #: 2

Requested by: Susan Busset Date: 5/30/94

Correction: EQUIPMENT - OMIT - 500 mL RD EVAPORATING FLASK AND 3 BALL MICRO SNYDER COLUMN

ADD - TURBOVAP II CONCENTRATOR

Reason (if applicable): _____

Correction has been implemented (Y/N): Y Date: _____

Correction will be implemented by (date): _____

Correction will be included in next SOP revision by (date): _____

APPROVAL

Laboratory Manager
Signature: Tom Carroll Date: 5/30/94

100892

HERITAGE LABORATORIES, Inc.

SOP Correction FORM

SOP Number: AM 406.0

SOP Title: PCB/PESTICIDE LIQUID/LIQUID EXTRACTIONS

Page #: 3

Requested by : SUSAN BUSSEY Date: 5/30/94

Correction: A MATRIX SPIKE (SPI02) AND A MATRIX SPIKE DUPLICATE (DPS02) ARE PREPARED AT A FREQUENCY OF 5% OF THE SAMPLES IF DOING METHOD SW846 -8080

Reason (if applicable): PER METHOD 5% of SAMPLES REQUIRE MATRIX SPIKE AND MATRIX SPIKE DUPLICATE.

Correction has been implemented (Y/N): Y Date : _____

Correction will be implemented by (date): _____

Correction will be included in next SOP revision by (date): _____

APPROVAL

Laboratory Manager
Signature: [signature] Date: 5/31/94

100892

HERITAGE LABORATORIES, Inc.

SOP Correction FORM

SOP Number: AM 406D

SOP Title: PCB/PESTICIDE LIQUID/LIQUID EXTRACTIONS

Page #: 4

Requested by : SUSAN BUSSEY Date: 5/30/94

Correction: SEE ATTACHED FOR CONCENTRATION PROCEDURE.

Reason (if applicable): TURBOVAP II CONCENTRATOR USED FOR INITIAL CONCENTRATION STEP.

Correction has been implemented (Y/N): Y Date :

Correction will be implemented by (date):

Correction will be included in next SOP revision by (date):

APPROVAL

Laboratory Manager
Signature: [signature] Date: 5/31/94

100892

Set the Turovap II concentrator at 50° and rinse the concentrator tube with methylene chloride. Pour approximately 180 mLs of the extract into the Turbovap concentrator tube. Place the concentrator tube into the appropriate position, set to sensor, turn on the nitrogen tank and adjust the flow to 20 - 27 p.s.i., making sure that no splashing occurs. Keep adding the remaining extract into the concentrator tube as the volume decreases. NEVER let the level of the extract go below the angled portion of the concentrator tube unless all of the extract has been added. At an apparent volume of approximately 10.0 mLs or less, after all of the extract has been added, add 50 mLs of hexane. When the sensor begins to beep, signaling a final volume of 0.5mLs, remove the tube promptly. Quantitatively transfer the extract to a 2 dram vial using hexane.

Approved mm Carroll 5/31/94

HERITAGE LABORATORIES, Inc.

SOP Correction FORM

SOP Number: AM 406.0

SOP Title: PCB/PESTICIDE LIQUID/LIQUID EXTRACTION

Page #: 6

Requested by: Susan Bussey Date: 5/29/94

Correction: #4 METHOD FOR BREAKING EMULSIONS IS NOT USED.

Reason (if applicable): _____

Correction has been implemented (Y/N): Y Date: _____

Correction will be implemented by (date): _____

Correction will be included in next SOP revision by (date): _____

APPROVAL

Laboratory Manager
Signature: [signature] Date: 5/30/94

100892

FIELD SAMPLING SOP

FIELD SAMPLING SOPs

SOP #1 - PH METER STANDARD OPERATING PROCEDURES

The pH measures the concentration of the hydrogen ion in a solution. A pH value of 7 is neutral, while pH values less than 7 indicate an acidic solution. Values greater than 7 are basic.

Equipment:

___ pH meter/temp probe
___ Paperwork
___ Standard solutions (4, 7, 10)
___ pH Meter Calibration Log

Procedures:

1. Pour sample into clean beaker

2. Rinse thermometer or temperature probe with distilled water and place in sample.

3. Remove cap from pH probe and rinse with distilled water.

4. Place probes in sample and allow to stabilize (10-20 seconds).

5. Take a pH and temperature reading. Reading must be within the two-point calibration or the meter must be recalibrated using a different standard solution (See pH meter calibration procedures).

6. Rinse probes with distilled water

7. Repeat the above two steps two times to collect a dual measurement of pH at its respective temperature.

8. Fill cap with distilled water and place on end of probe.

pH Meter Calibration:

Equipment:

___ pH standards (4, 7, and 10)

___ Distilled water

___ Thermometer

Note: pH standards and distilled water should be stored in similar locations so temperature is the same.

Procedures:

1. Remove cap from pH probe and rinse it along with the thermometer (or temperature probe) with distilled water.

2. Place pH probe and thermometer (or temperature probe) in pH 7 standard solution and allow to stabilize for 10 to 20 seconds. Push the "CAL" button on the meter.

3. Remove pH probes from solution and rinse with distilled water.

4. Place pH probe and thermometer (or temperature probe) in pH 4 or 10 standard solution and allow to stabilize for several seconds. Push the "CON" button. Note: Use the sample to determine which standard to use. If sample has a pH value less than 7, use 4 solution. If sample has a pH value greater than 7, use 10 solution. This allows the slope of the meter to be consistent with characteristics of the sample.

5. Remove pH probe and thermometer (or temperature probe) from solution and rinse with distilled water.

6. Place pH probe and thermometer (or temperature probe) in pH 7 standard solution again and allow to stabilize. Take a reading. Repeat for standard 4 or 10. Each reading must be within $\pm$ 0.1 of the standard solution.

7. Fill cap for pH probe with distilled water (to keep probe moist) and place it on probe.

8. Record all calibration details on pH Meter Calibration Log, Health and Safety Log, and Water Sampling Log (if applicable) and submit to Document Custodian.

QA/QC Requirements:

pH meter calibration should be checked with a 7-standard solution every four hours. If reading is greater than $\pm$ 0.1 of standard, repeat calibration process.

Standard solutions should be replaced every six months.

One replicate pH measurement per every five investigative measurements or one per day, whichever is greater, must be made.

SOP #2 - SPECIFIC CONDUCTIVITY METER STANDARD OPERATING PROCEDURES

Equipment:

___ Specific conductivity meter
___ Standard solution (1413 μmhos/cm)
___ Specific Conductivity Meter Calibration Log
___ Paperwork

The specific conductivity of a substance refers to its ability to conduct an electric current. This value provides a measure of the concentration of dissolved solids in water samples.

Procedures:

1. Pour sample into clean beaker.

2. Rinse probe with distilled water.

3. Insert conductivity probe into sample and allow it to stabilize for 10 to 20 seconds. The probe automatically adjusts for temperature.

4. Take a reading and record on Sampling Log.

5. Rinse probe with distilled water.

6. Repeat the above two steps two times to collect a dual measurement of specific conductance.

Specific Conductivity Meter Calibration:

Equipment:

___ Conductivity Standard (1413 μmhos/cm)

___ Distilled water

Conductivity standards and distilled water should be stored in similar locations so temperature is the same.

Procedures:

1. Rinse conductivity probe with distilled water.

2. Place probe in 1413 standard and allow to stabilize for 10 to 20 seconds.

3. Take reading. If necessary, adjust calibrations screw to ± 10 μmhos/cm (probe automatically adjusts for temperature). Record value on Specific Conductivity Meter Calibration Log and Water Sampling Log (if applicable).

4. Rinse probe with distilled water.

5. Record all calibration details on Specific Conductance Meter Calibration Log, Health and Safety Log, and Water Sampling Log (if applicable) and submit to Document Custodian.

QA/QC Requirements:

Specific conductivity calibration should be checked every four hours. If reading is greater than ± 10 μmhos/cm of standard, repeat calibration.

Standard solutions should be replaced every nine months per manufacturer recommendations.

One replicate specific conductance measurement set should be made per every five investigative measurements or every day, whichever is greater.

SOP #3 - A) HNU PHOTOIONIZATION DETECTOR PROCEDURES
B) OVA FLAME IONIZATION DETECTOR PROCEDURES

Equipment:

___ HNu Model P1 101 (10.2 eV lamp)

___ OVA Model 128 Foxboro Organic Vapor Analyzer

___ Calibrant Gases (HNu-Isobutylene: 20-200 ppm and 0-20 ppm) (OVA-Methane: 100 ppm

___ HNu/OVA Calibration Instruction

___ Flow meter ___ Paperwork

Procedure (A): HNu PID

Instrument Set-Up:

1. Prior to calibration, check the function switch on the control panel to make sure it is in the "OFF" position. The probe nozzle is stored inside the instrument cover. Remove cover plate by pulling up on the pins that fasten the cover plate.

2. Remove the nozzle from the cover. Assemble probe by screwing nozzle into casing.

3. Attach probe cable to instrument box inserting 12 pin interface connector of the probe into the connector on the instrument panel. Match the alignment keys and insert connector. Turn connector in clockwise direction until a distinct snap and lock is felt.

4. Turn the function switch to the Battery Check position. When the battery is charged, the needle should read within or above the green battery arc on the scale plate. If the needle is below the green arc or the red LED light comes on, the instrument should be recharged prior to making any measurements.

5. Turn the function switch to the "ON" position. In this position, the UV light source should be on. To verify, gaze at the end of the probe for a purple glow. Do not look directly at the lamp itself. If the lamp does not come on refer to the Instruction Manual.

6. To zero the instrument, turn the function switch to the standby position and rotate the zero potentiometer until the meter reads zero. Clockwise rotation of the zero potentiometer produces an upscale deflection while counter clockwise rotation yields a downscale deflection. (Note: No zero gas is needed since this is an electronic zero adjustment.) If the span adjustment is changed during instrument calibrations, the zero should be rechecked and adjusted. If necessary, wait 15 to 20 seconds to ensure that the zero reading is stable. Readjust as necessary.

Instrument Daily Calibration:

1. Insert one end of T tube into probe. Insert second end of probe into calibration gas in the 20-200 ppm range. The third end of probe should have the rotameter (bubble meter) attached.

2. Set the function switch in the 0-200 ppm range. Crack the valve on the pressured calibration gas container until a slight flow is indicated on the rotameter. The instrument will draw in the volume required for detection with the rotameter indicating excess flow.

3. Adjust the span potentiometer so that the instrument is reading the exact value of the calibration gas. (Calibration gas value is labeled on the cylinder.)

4. Turn instrument switch to the standby position and check the electronic zero. Reset zero potentiometer as necessary following step 6 above.

5. Record on field-data sheet all original and readjusted setting.

6. Set the function switch to 0-20 ppm. Remove the mid-range (20-200 ppm) calibration gas cylinder and attach the low-range (0-20 ppm) calibration gas cylinder as described above.

7. Do not adjust the span potentiometer. The observed reading should be $\pm$3 ppm of the concentration specified for the low-range calibration gas. If this is not the case, recalibrate the mid-range scale repeating Step 1 through 6 above. If the low-range reading consistently falls outside the recommended tolerance range, the probe light source window likely needs cleaning. Clean window according to instruction manual. When the observed reading is within the required tolerances, the instrument is fully calibrated.

Instrument Calibration Check:

1. Exit the exclusion zone and turn meter to "ON" position. Check that the meter is reading a value of zero.

2. Insert one end of T-tube into probe and other end into calibration gas. The third end of the T-tube should be attached to a flow meter.

3. Crack the valve on the calibration gas and read the value shown by the instrument. Record the value and calibrant gas concentration in the field notebook.

4. If the value shown by the instrument is greater than $\pm$20% of the calibrant gas concentration, take meter outside of exclusion zone and recalibrate as outlined above.

Sample Measurement:

1. Place function switch in 0-20 ppm range for field monitoring. This will allow for most sensitive, quick response in detecting airborne contaminants.

2. Before entering a potentially contaminated area, determine background concentration. This concentration should be used as a reference to readings made in the contaminated area. Under no circumstance should one attempt to adjust the zero or span adjustments while the instrument is being operated in the field.

3. Take measurements in the area of interest recording readings and locations. Should readings exceed the 0-20 scale, switch the function switch to the 0-200 or 0-2,000 range as appropriate to receive a direct reading. Return the instrument switch to the 0-20 range when readings are reduced to that level. Record measurements on field-data sheet.

Note: The instrument will not function properly in high humidity or when the window to the light housing is dirty. If the instrument response is erratic or lower than expected, recalibrate or obtain a different meter and calibrate as outlined above.

4. When finished, reverse Steps 1 through 6 in Instrument Setup section to shut down the instrument.

QA/QC Requirements:

The instrument must undergo a 2-point calibration as described above every morning before commencement of field work. The readings from the HNu or similar device will be used to screen soil and groundwater samples and to monitor air quality in the breathing zone during sampling or drilling activities.

Reference: Modified from TSAI, U.S. EPA Region V, QAS.

Procedure (B): OVA FID

Field Operations:

1. Check battery condition by moving the INSTR Switch to the BATT position.

2. Move PUMP Switch to "ON" position, then place instrument in vertical position and check SAMPLE FLOW RATE indication. The normal range is 1.5 to 2.5 units. If less, check filters.

3. Open the HYDROGEN TANK VALVE and the HYDROGEN SUPPLY VALVE. Wait one minute for hydrogen to purge the system.

4. Depress Igniter Button until burner lights. Do not depress Igniter Button for more than six seconds (if burner does not ignite, let hydrogen flow for one minute and again attempt ignition).

5. After ignition, Allow approximately five minutes for instrument warm-up. After warm-up, the meter should display a normal background hydrocarbon concentration between 5 and 10 ppm.

6. To shut down the OVA, perform the following:
   a) Close the HYDROGEN SUPPLY VALVE
   b) Close the HYDROGEN TANK VALVE
   c) Move the INSTR Switch and PUMP Switch to "OFF"
   d) Instrument is now in the shut down configuration

Instrument Daily Calibration:

1. Place instrument in normal operation with CALIBRATE Switch set to X10 and GAS SELECT dial set to 300, and allow 20 minutes for warm up and stabilization.

2. Use the CALIBRATE ADJUST (zero) knob to adjust the meter reading to zero.

3. Introduce a methane sample of a known concentration (100 ppm) and adjust trimpot R32 so the meter reading corresponds to the known sample.

4. Extinguish the flame by blocking the exhaust ports or turning the hydrogen supply and pressure valves off.

5. Leave CALIBRATE Switch on x10 position and use CALIBRATE ADJUST (zero) knob to adjust Readout meter reading to 4 ppm.

6. Move the CALIBRATE Switch to the X1 position and using trimpot R31, adjust Readout meter to 4 ppm.

7. Move CALIBRATE Switch to X10 position again. Use CALIBRATE ADJUST (zero) knob to adjust Readout meter to 40 ppm.

8. Move CALIBRATE Switch X100 position and use trimpot R33 to adjust Readout meter to 4 ppm.

9. Move CALIBRATE Switch back to X10 scale. Rezero Readout meter to 0 ppm.

10. Unit is now balanced over the full range.

Instrument Calibration Check:

1. Once the OVA is operating properly, place the readout scale to the X10 position.

2. Connect the tube of the calibration gas (100 ppm methane) to the end of the probe of the OVA.

3. Open the valve of the calibration gas. Read the concentration on the readout dial. It should read approximately 10 ppm (1 ppm on the X100 scale or 100 ppm on the X1 scale). NOTE: Concentration should be within $\pm$20% of actual concentration.

Sample Measurement:

1. Place the meter scale to the X1 position. This will allow for most sensitive, quick response in detecting airborne contaminants.

2. Before entering a contaminated area, determine background concentration. This concentration should be used as a reference to readings made in the contaminated area. Under no circumstance should one attempt to adjust the zero or span adjustments while the instrument is being operated in the field.

3. Take measurements in contaminated area, recording readings and locations. Should readings exceed the X1 position when readings are reduced to that level. Record all measurements on the Health and Safety Log.

NOTE: The instrument will not function properly in extreme cold or hot conditions. If meter readings become erratic, attempt to calibrate or use a different meter.

QA/QC Requirements:

The instrument must undergo a 2-point calibration as described above every morning before commencement of field work. The readings from the OVA will be used to screen soil and groundwater samples and to monitor the air quality in the breathing zone during sampling or drilling activities.

Reference: Modified from TSAI, U.S. EPA Region V, QAS.

APPENDIX C

Health and Safety Plan

HEALTH AND SAFETY PLAN
NAVISTAR INTERNATIONAL TRANSPORTATION COMPANY/ BURLINGTON NORTHERN RAILROAD/ IOWA INTERSTATE RAILROAD PROPERTIES ROCK ISLAND, ILLINOIS

June 1994

Prepared for:

Navistar International Transportation Corporation
455 North Cityfront Plaza Drive
Chicago, Illinois 60601

and

Burlington Northern Railroad
4105 North Lexington Avenue, Suite 300
Arden Hills, Minnesota 55126-6181

Prepared by:

Geraghty & Miller, Inc.
35 East Wacker Drive, Suite 1000
Chicago, Illinois 60601
312/263-6703

CONTENTS

CONTENTS (continued)

TABLES

FIGURE

ATTACHMENT

HEALTH AND SAFETY PLAN
NAVISTAR INTERNATIONAL TRANSPORTATION COMPANY/ BURLINGTON NORTHERN RAILROAD/ IOWA INTERSTATE RAILROAD PROPERTIES ROCK ISLAND, ILLINOIS

PROJECT NAME:	Phase II Site Investigation, Navistar International Transportation Company/Burlington Northern Railroad/ Iowa Interstate Railroad Properties, Rock Island, Illinois
PROJECT NUMBER:	CI0299.003
PROJECT LOCATION:	Rock Island, Illinois
CLIENTS:	Navistar International Transportation Corporation/Burlington Northern Railroad
SITE DESCRIPTION:	The site is located along 5th Avenue in Rock Island, at approximately 44th Avenue adjacent to Sylvan Slough.

WORK DESCRIPTION:

- Completion of exploratory soil borings utilizing a truck mounted drill rig.
- Collection of soil samples utilizing split-spoon sampling methods for analysis.
- Installation of monitoring wells
- Collection of groundwater samples with a disposable bailer

PRIME CONTRACTOR:	Geraghty & Miller, Inc
PROJECT MANAGER:	James P. Auer
H&S COORDINATOR:	Kevin J. Ormsby
SITE SAFETY OFFICER:	Geraghty & Miller Field Team Leader
USEPA OSC:	Julie Zakutansky
WORK SCHEDULE:	July and August, 1994

HEALTH AND SAFETY PLAN
NAVISTAR INTERNATIONAL TRANSPORTATION COMPANY/ BURLINGTON NORTHERN RAILROAD/ IOWA INTERSTATE RAILROAD PROPERTIES ROCK ISLAND, ILLINOIS

INTRODUCTION

This health and safety plan (HSP) is developed for use during the Phase II Site Investigation and related removal action activities at the Navistar International Transportation Company (Navistar), Burlington Northern Railroad (BNR), and Iowa Interstate Railroad (IIR) properties (the Navistar/BNR/IIR site) in Rock Island, Illinois. The elements of the HSP pertain to the requirements outlined in the Occupational Safety and Health Administration (OSHA) Final Rule, 29 CFR Part 1910.120. The objective of this HSP is to ensure safe working conditions at the site. The protection of workers and environmental health and safety are major concerns. The safety organization and procedures have been established based on an analysis of potential hazards. Personnel protection measures have been selected in response to these risks. As new information is gathered and additional tasks are performed, it may be necessary to revise the HSP.

To ensure the safety and health if workers and the general public, all reasonable precautions will be taken by Geraghty & Miller, Inc and its subcontractors. All work will be performed in accordance with the health and safety requirements described herein, and all appropriate federal, state, and local health and safety regulations.

GERAGHTY & MILLER, INC RESPONSIBILITIES

Geraghty & Miller will be responsible for the implementation and enforcement of the HSP during the investigation, and will ensure all work is performed in accordance with the current edition of OSHA rules for hazardous waste operations, and all appropriate federal, state, and local health and safety regulations.

The project manager is ultimately responsible for ensuring that all project participants abide by the requirements outlined in this health and safety plan. The Geraghty & Miller, Inc health and safety coordinator (HSC) will provide technical coordination and support of the health and safety program. The HSC will act in an advisory capacity to the site safety officer.

In addition to the HSC, a site safety officer (SSO) and an alternate is assigned to the site under investigation. The SSO is responsible for field implementation and enforcement of the HSP. The SSO must conduct health and safety meetings with field personnel prior to any field activities, and provide all related documentation. Daily surveillance and monitoring will be conducted to ensure proper HSP implementation. The SSO will be familiar with all construction standards and methods, drilling and installation techniques, and sampling procedures. The SSO and USEPA On-Scene Coordinator (OSC) will have the authority to stop work if worker or public health are threatened by the aforementioned site operations, and may implement requirements in addition to those described herein on a case-by-case basis. The SSO, HSC, and Project Manager will take action in consultation with, and as directed by, the OSC to re-establish safe working conditions and safeguard site personnel, the public, and environment should an unforseen or site-specific safety related factor, hazard, or condition become evident during the operation.

SITE DESCRIPTION

PHYSICAL SETTING AND LOCATION

The former International Harvester Farmall (Farmall) manufacturing facility, now known as the QCIC, is located adjacent to the Sylvan Slough. The Sylvan Slough is a tributary of the Mississippi River and flows between the site and Rock Island Arsenal, along 5th Avenue at 44th Street in Rock Island, Illinois. The former Farmall facility occupied approximately 80 acres, 20 of which are currently owned by Navistar, the remaining 60 acres, including the former facility buildings, are currently owned by the L.R. Christenson Company, the management firm

operating the QCIC. The QCIC facility is approximately 1,250 feet (ft) wide and 8,250 ft long and occupies about 1.6 million square ft of floor space.

The Navistar portion of the former Farmall property extends immediately adjacent to the Sylvan Slough between the eastern property boundaries at 46th Street (the boundary between the Cities of Rock Island and Moline) and the western property boundary at about 28th Street. The first 5 feet of land immediately along the Sylvan Slough is owned by BNR. BNR also owns a parcel of property located immediately west of the QCIC property and south of the Navistar property. A layout of the current ownership of the former Farmall property and the location of the BNR property are depicted on Figure 2-2.

The general topography of the Navistar, BNR, IIR and QCIC properties is relatively flat, with a gentle westward slope, and with notable slopes between each separate parcel of land. Generally, the BNR and IIR properties are approximately 5 feet lower than the Navistar and QCIC properties. The northern edge of the Navistar property drops off approximately 20 ft to the Sylvan Slough, which is located immediately north of the Navistar, BNR, and QCIC properties. According to an elevation survey conducted by Beling Consultants, Inc. at each monitoring well location, the average ground elevations of monitoring wells at the Navistar, BNR, and QCIC properties are 567.3 ft above mean sea level (ft msl), 563.4 ft msl, and 569.0 ft msl (Beling Consultants, Inc. 1993).

REGIONAL GEOLOGICAL/HYDROGEOLOGICAL SETTING

The Navistar, BNR, and QCIC properties are located on predominantly man-made fill and sand and gravel river deposits overlying Pleistocene to recent-aged alluvium or Devonian-aged shale and limestone. The undeveloped western portion of the Navistar property has approximately 15 to 20 feet of fill in place. The fill material encountered at the site consists of primarily black sands and cinders that likely originated from the on-site foundry that was in operation until 1967. Below the fill material is minimum of 10 feet of sands deposited by the Mississippi River. The sands and gravels overlie the limestone and shale.

At the BNR site, no fill material is present. The soils at the BNR property consist strictly of alluvial (river) sand and gravel deposits, which overlie limestone or shale. As determined by soil borings advanced on site, the thickness of the unconsolidated and gravel deposits is 15 feet on average.

SOIL ANALYSES

Eight soil samples were for laboratory analyses collected from GM-1 through GM-6. The soil samples were submitted for chemical analyses to Analytical Technologies, Inc. Seven volatile organic compounds (VOCs) were detected in the subsurface soil during the Initial Site Investigation. The VOCs detected include acetone, benzene, 2-butanone (commonly known as methyl ethyl ketone [MEK]), ethylbenzene, methylene chloride, trichlorofluoromethane, and xylenes. Acetone, MEK, and methylene chloride are common laboratory contaminants, while benzene, ethylbenzene, and xylenes are associated with petroleum products. Trichlorofluoromethane is a freon isomer.

Concentrations of polynuclear aromatic hydrocarbons (PNAs) were also detected in the boring samples. The PNA concentrations differed in samples taken near the surface as compared to samples taken near the water table. PNA concentrations near the water table were substantially higher. PCB and lead concentrations were detected in one and two of the soil samples, respectively.

PLANNED SITE ACTIVITIES

The field activities at the site will consist of the following:

- Completion of exploratory soil borings utilizing a truck mounted drill rig.
- Collection of soil samples utilizing split-spoon sampling methods for analysis.
- Installation of monitoring wells.
- Collection of groundwater samples with a disposable bailer.

SITE-SPECIFIC HAZARD EVALUATION

CHEMICAL HAZARDS

The chemical contamination at the site consists of VOCs, PNAs, PCBs, and lead. The potential chemical hazards which may be encountered during field work at the site include:

- ingestion of contaminated waste
- inhalation of contaminated waste particles, vapors, or gases
- dermal contact with contaminated waste
- dermal contact with contaminated equipment and structures

Attachment 1 contains information on the characteristics of these compounds which could potentially be encountered by Geraghty & Miller field personnel and subcontractors during the planned field activities at the site.

PHYSICAL HAZARDS

Typical hazards associated with drilling, coring, sampling, and field testing activities also present potential for injury. Hazards are posed by heavy equipment, unseen obstacles, utilities, and heat-related stress. The hazards encountered during these field activities include climbing hazards, lifting hazards, lacerations and contusions, noise exposure, heat stress, and electric shock.

Climbing Hazards

While performing activities outlined in the work scope of this report, field personnel and workers may need to climb in the equipment to fulfill required tasks. Any climbing activities must conform with OSHA standards.

Lifting Hazards

Drilling operations involve the manual movement of drill casing, auger flights, and various other pieces of equipment, thus exposing subcontractors to potential injury. All field team members should be trained in the proper method used to lift heavy equipment and cautioned against lifting objects which are too heavy for an individual.

Lacerations and Contusions

While conducting tasks associated with this project, the field team may cut or bruise themselves due to contact with moving machinery and physical objects. So that field personnel and workers may disinfect and bandage minor cuts and bruises, a first-aid kit will be kept on-site. First-aid materials must be sealed in individual packages, stored in a weatherproof container, and inspected on a weekly basis for completeness.

Serious contusions may result from falling objects, flying objects, or being caught between idle or moving pieces of machinery. Care must be taken to avoid these situations when working with heavy equipment.

Noise Exposure

Excessive noise levels from drilling equipment are possible. Thus, hearing protection may be necessary during drilling activities.

Heat Stress

If heavy work is performed under high air temperatures, heat stress is likely to occur, especially when protective clothing inhibits the body's ability to cool itself. Both heat exhaustion and heat stroke may occur. Though less severe than heat stroke, heat exhaustion is indicated by symptoms such as pale and moist skin, heavy sweating, headache, nausea, dizziness, and

vomiting. Heat stroke, which is life-threatening, has symptoms of hot, red skin, very small pupils, very high body temperature, and a cessation of sweating.

Cold Stress

Excessive loss of body heat (hypothermia) and/or frostbite may be caused by prolonged exposure to excessive cold or wet conditions. Ambient air temperature and wind velocity are two factors that influence the development of cold weather injuries.

The first cold weather-related injury is frostbite. Areas of the body which have high surface area-to-volume ratios such as fingers, toes, and ears are most susceptible to frostbite. Three categories of frostbite exist. Frost nip, or incipient frostbite, is characterized by a blanching or whitening of the skin. In the case of superficial frostbite, the skin has a waxy or white appearance and is firm to the touch, though the tissue beneath is resilient. Deep frostbite, which is an extremely serious injury, results in tissues that are cold, pale, and solid.

The second type of cold weather-related injury is hypothermia. The symptoms of systemic hypothermia, which is caused by exposure to freezing or rapidly dropping temperatures, are exhibited in five stages: 1) shivering, 2) apathy, listlessness, and sleepiness, 3) unconscious, glassy stare with a slow pulse and slow respiratory rate, 4) freezing of the extremities, and 5) death.

Electric Shock

The potential for cutting into buried underground electric utility lines exists whenever the ground is penetrated. Prior to the start of any field activities, utility lines should be determined and clearly delineated in the selected area for work. All field personnel and workers should be explicitly informed of utility line locations.

PERSONNEL PROTECTION PROGRAM

EMPLOYEE TRAINING REQUIREMENTS

Prior to the commencement of any on-site work, safety meetings will be conducted by the SSO. Further, all Geraghty & Miller personnel, subcontractors, and others participating in field activities must meet training requirements outlined in OSHA Standard 29 CFR 1910.120 covering hazardous waste operations and emergency response. These requirements include an initial 40-hour training program consisting of classroom and hands-on experience in the use of personal protective equipment (PPE), safe operating practices, identification of potential hazards or hazardous situations, in accordance with the OSHA standard. All field personnel must attend eight hours of refresher training in addition to the 40-hour training program, and new employees must perform three days of work activity under the supervision of a trained and experienced work supervisor. Selected Geraghty & Miller employees working at the site will complete a CPR/First Aid course which has been certified by the American Red Cross. Documentation confirming these requirements will be retained at the command post of the SSO for reference.

LEVELS OF PERSONAL PROTECTION

All drilling and sampling activities will initially be performed in Level D personal protective equipment (PPE). Depending on results obtained from field analyses, this level of protection may be upgraded to Level C. However, project personnel will always take precautions to avoid dermal and inhalation exposure and ingestion at all sample locations.

The levels of protection and associated equipment are as follows:

Level D

Level D PPE is worn during activities which do not suggest a need for any initial respiratory protection, but when dermal protection is warranted. The equipment to be utilized includes:

Tyvek™ or poly-coated Tyvek™ coveralls
steel-toed, steel shank boots
hard hat
safety glasses with permanently fixed side shields
gloves: vinyl or latex
disposable booties
hearing protection (if necessary)
finger rings will not be worn

Level C

Level C is to be worn when all criteria for air-purifying respiratory protection are satisfied, and the potential for dermal absorption or damage is limited or non-existent. Level C PPE includes:

Tyvek™ or Saranac coveralls
steel-toed and shanked boots
hard hat
inner gloves: surgical type
outer gloves: nitrile, viton, silver shields or equivalent
outer boot covers
full-face respirators with appropriate cartridges
hearing protection (if necessary)

LIMITATIONS OF PROTECTIVE CLOTHING

The designated PPE ensembles have been selected to provide protection against potential contaminants and physical hazards. However, no protective garment, glove, or boot is chemical proof, nor can it afford protection against all chemical types. Chemical permeation through the PPE is governed by contaminant concentrations, environmental conditions, physical conditions of the protective garment, and resistance of the garment to specific contaminants.

To obtain optimum performance from the PPE, the following procedure should be followed. When using coveralls, don a clean, new garment after each rest break at the beginning of each shift. Inspect all clothing, gloves, and boots prior to use for imperfect seams,

non-uniform coatings, tears, or poorly functional closures. Inspect reusable garments, boots, and gloves prior to and during use for visible signs of chemical permeation, swelling, discoloration, stiffness, brittleness, cracks, punctures, and any signs of abrasion. Discard reusable gloves, boots, or coveralls exhibiting any of the aforementioned characteristics. In areas known to exhibit elevated concentrations of contaminants, PPE will not be reused.

MEDICAL AND ENVIRONMENTAL SURVEILLANCE

HEALTH MONITORING

Geraghty & Miller has developed a health monitoring program in order to detect potential health impacts resulting from exposure to chemicals. All Geraghty & Miller and subcontractor personnel involved with the Navistar/BNR/IIR site shall have undergone a yearly physical examination as required in 29 CFR 1910.120 (f). Geraghty & Miller obtains and furnishes employees with a copy of written opinion from the examining physician, including the results of the medical examination, tests, and physician's recommended limitations upon the employees' assigned work. The examination includes a medical and work history.

During the physical examination, the following medical parameters are evaluated:

- Complete personal, family, and environmental history;
- Comprehensive physical examination;
- Complete laboratory screen;
- Urinalysis;
- Chest X-ray (once every three years);
- Resting electrocardiogram;
- Pulmonary function testing;
- Tonometry (35 years of age or older)
- Audiometric screening
- Vision and color blindness testing; and,

- Hemocult testing.

HEAT STRESS MONITORING

If heavy work is performed under high air temperatures, heat stress is likely to occur, especially when protective clothing inhibits the body's ability to cool itself. Heat stress is caused by several interacting factors, such as environmental conditions, clothing work load, physical condition, characteristics of the employee, and type of PPE required for the work task. Heat stress may be of concern when dry bulb air temperature exceeds 70 degrees fahrenheit (°F).

To protect workers from heat stress, personnel must be monitored for the signs of heat stress. Also, the SSO must ensure that appropriate liquids are provided for employees, and that employees are drinking more than the amount required to satisfy thirst. During hot weather, rest periods will be provided as needed to allow personnel to cool down. Rest periods should be taken as needed in a shaded area if possible and employees should remove protective clothing.

COLD STRESS MONITORING

Persons exposed to temperatures at or below freezing or wind-chill temperatures of 10 °F may experience weather-related injuries in the forms of the previously described frostbite and hypothermia. The two factors that influence the development of a cold injury are ambient temperature and wind velocity. The term "wind chill" describes the chilling effects of moving air in combination with low temperatures. For example, 10 °F with a wind velocity of 15 miles per hour (mph) is the equivalent in chilling effect of still air at -18 °F. In general, the greatest incremental increase in wind velocity occurs when a wind of 5 mph increases to 10 mph. Thus the dangers of cold-related stress on a cold, windy day is greater than on a cold day with little or no wind. Further, water conducts heat 240 times faster than air. Thus the body cools suddenly when chemical-protective equipment is removed if the clothing underneath is

perspiration-soaked. The SSO will assess site-specific weather conditions to determine if it is appropriate for the site workers to remove protective clothing outdoors.

To minimize cold weather-related stresses, site workers should wear thermal socks, long cotton or thermal underwear, hard hat liners and other cold weather gear. Also, blankets, warm drinks other than caffeinated coffees, and warm break areas are essential. Finally, personnel must be briefed on the dangers of frostbite and hypothermia. Self-monitoring and co-worker monitoring will be highly encouraged.

OTHER WEATHER-RELATED STRESS MONITORING

Serious hazards may result from adverse weather. The Geraghty & Miller SSO may decide to discontinue drilling or other field activity because of severe and threatening weather conditions including lightning, strong winds, heavy rain, and very hot temperatures.

AIR MONITORING

Air monitoring will be conducted during certain work tasks to protect field personnel from exposure to airborne hazardous substances and health hazards, as well as to determine appropriate levels of personal protective equipment for the given work plan. Prior to the start-up of any work tasks, initial air monitoring will be performed. A baseline (ambient) air quality value will be determined by monitoring upwind. Air quality in the breathing zone will be evaluated by monitoring organic vapor levels. For this purpose, a photoionization detector (PID) or flame ionization detector (FID) will be utilized. This air monitoring equipment will be calibrated daily according to manufacturer instructions. Throughout the drilling phase, air monitoring readings will be collected near the borehole and within the breathing zone when the drill bit first penetrates ground surface, and, at a minimum, 15 minutes thereafter. Readings will also be taken during sampling to ensure that organic vapor readings are at background levels. The SSO may alter this schedule as new information is obtained regarding health hazards at the site.

Results of the monitoring, in addition to a knowledge of potential chemical hazards at the work site, will be used to determine when an "action level" for a particular location has been reached. The "action level" is the level of organic vapors that indicates a need to upgrade the level of PPE being used by personnel. If vapor concentrations approach action levels, continuous monitoring will be conducted, and all calibration and measurement information will be recorded in the field logbook.

At an area known to have hydrocarbon contamination, specific procedures must be followed. When breathing zone readings indicate that a worker is being exposed to a sustained level (greater than 5 minutes duration) of 15 ppm (the STEL for benzene) above the ambient air level, air-purifying respirators (APR's) with organic vapor cartridges will be donned by all workers in the work area. At sustained levels of 500 ppm (IDLH for benzene), personnel will exit the work area until benzene levels decrease.

As stated previously, Level D will be the initial level of protection to be utilized throughout the drilling and sampling activities. If ambient air conditions exceed the background level of VOC vapors for a sustained period of ten minutes or more, Level D will be considered insufficient and all work will cease and options will be evaluated, including and upgrade to Level C. The personnel protection level may be downgraded by the SSO to Level D when all monitoring parameters remain at or below background in the breathing zone for ten minutes or more.

SAFE WORK PRACTICES

GENERAL WORK RULES

General safe work practices to be followed by field practices are presented below.

- Field work will be conducted only during daylight hours unless adequate artificial lighting is provided.

- Eating, drinking, chewing of gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer an ingestion of material is prohibited in any work area. The entire body should be washed thoroughly as soon as possible after leaving the work site.

- No excessive facial hair, which interferes with a satisfactory fit of the mask-to-face seal, is allowed on personnel required to wear respiratory protective equipment.

- All personnel assigned for on-site activities will be adequately trained and thoroughly briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures, and communications.

- Field personnel must observe each other for signs of toxic exposure and heat/cold illness. Indications of adverse effects include, but are not limited to:

  - Changes in complexion and skin discoloration;
  - Changes in coordination;
  - Changes in demeanor;
  - Excessive salivation and pupillary response; or
  - Changes in speech pattern.

- Personnel must also be conscious of non-visual effects of illness such as headaches, dizziness, nausea, blurred vision, cramps, or irritation of eyes, skin, or respiratory tract.

- If any conditions of explosivity or unusual conditions are observed, exit immediately and contact the SSO or project manager.

GENERAL ON-SITE FIRST-AID

- Contaminated materials get into the eyes - Wash eyes with copious amounts of water for at least 15 minutes. Lift upper and lower lids occasionally. Seek medical attention immediately.

- Contaminated materials contact skin - Promptly wash area with soap or mild detergent and water. Flush well with water. Check for signs of skin irritation. Seek medical attention if unusual appearance or skin sensation is noted.

- Contaminated materials penetrate protective clothing - Discard protective clothing. Wash skin as described above. Confer with Site Safety Officer in selection of new protective clothing.

- Inhalation of contaminated air - Move person to well-ventilated area at once. If individual is not noticeably overcome, and has no side effects after about five minutes, return to work is allowed.

- Ingestion of contaminated materials - Flush mouth with water, being careful not to swallow. Contact local poison center (1-800-543-2022). When called for, induce vomiting (DO NOT induce vomiting in unconscious persons). Seek medical attention promptly.

DRILLING OPERATIONS SAFETY

Drill rig setup and operation can pose many hazards. The drill crew is generally responsible for the safe operation of the drill rig; however, Geraghty & Miller personnel must be aware of safety considerations. To minimize the hazards associated with drilling operations, the following practices should be avoided:

- Standing too close to the rig, especially its moving parts;
- Standing near pipe hoist or rig exhaust;
- Walking on drilling rods or casing, or near the edge of a mud pit;
- Climbing on rig to take pictures or admire the view;
- Refueling an engine while it is still running or hot; and
- Wearing loose fitting clothing.

Further, because the site is contaminated with hydrocarbons, the following precautions and safety considerations will help to avoid and/or minimize chemical hazards:

- Adherence to wearing personal protective clothing as outlined in the HSP.

- Avoid kneeling, lying in, sitting on contaminated ground or materials, unless required. If required, use plastic sheeting.

- Avoid or minimize the handling of contaminated materials.

- Keep clean water available for decontamination, washing, or dust control.

- Set up rig in upwind direction, if possible. A crosswind would be the second choice.

HEAVY EQUIPMENT SAFETY

Heavy equipment can also represent a substantial hazard to workers. When heavy equipment is in use, the following guidelines should be followed:

- Use common sense. Never walk in back of or to the side of heavy equipment without the operator's knowledge.

- The proper protective equipment should be worn as specified in the health and safety plan. Hard hats, steel toed boots, and safety glasses should be worn at all times near heavy equipment.

- Remain alert and maintain visual contact at all times.

- Establish hand signal communication when verbal communication is difficult.

- Be aware of footing at all times.

- All heavy equipment shall have backup alarms of some type.

- Only qualified/licensed people are to operate heavy equipment.

- Use chains, hoists, straps, and any other equipment to safely aid in moving materials.

- Use proper lifting techniques. For example, use your legs, not your back.

- Never use a piece of equipment unless you are familiar with its operation

- Take all precautions when moving pipe/well sections.

- Instruct equipment operators to report to their supervisor any abnormalities such as equipment failure, oozing liquids, and unusual odors.

SITE VISITOR PROTECTION

Visitors to the site will be instructed to remain outside of the work area. Visitors will be cautioned to avoid skin contact with contaminated or suspected contaminated surfaces.

During visitation, hand-to-mouth transfers will be reduced with special precautions not to eat, drink, smoke, or chew gum or tobacco. The use of alcohol prior to or during site visitation is prohibited.

Any visitors entering the work area must wear the appropriate personal protective equipment. Authorized visitors requiring observation of the field activities must read the HSP and sign a form stating that they have read and understand the safety protocol and will abide by it.

SITE CONTROL

The site safety officer will designate the exclusion zone, contamination reduction zone, and support zone for the site. The exclusion zone is the area where physical or chemical hazards exist or could occur. The purpose of the zone is to limit the spread of contaminants to clean areas and to provide for the safety of those persons not authorized to enter the zone. Flagging tape will delineate the exclusion zone, and only persons authorized by the site safety officer will be granted admission to the area.

The contamination reduction zone is an area which further serves to reduce the possibility of the clean zone becoming contaminated. This area will be established if site conditions dictate that Level D protection may be upgraded to Level C protection. The contamination reduction zone limits the spread of contaminants through a combination of decontamination, distance between exclusion and support zone, air dilution, zone restrictions, and work functions. Decontamination stations will be set-up at the boundary between the exclusion and contamination reduction zones.

The support zone is defined as the area outside the zone of potential contamination. This zone serves as an entry area to be used for personnel, material, and equipment for site operations. It will further serve as an area for uncontaminated safety and work equipment, and

an area for rest breaks, the consumption of food and beverages, and all activities that serve in a role in a supportive role to the investigating personnel.

DECONTAMINATION PROCEDURES

Decontamination is the process of removing or neutralizing contaminants from personnel or equipment. The decontamination process will prevent the transport of potentially harmful materials into unaffected areas. Decontamination also protects the worker from contaminants that have accumulated on PPE, vehicles, tools, and other equipment. Appropriate decontamination procedures must be followed by all personnel performing work tasks in an exclusion zone, regardless of work task or protection level used.

Decontamination of equipment will consist primarily of removal of gross contamination, using a brush and laboratory-grade detergent solution, and then rinsing with distilled water. All drilling equipment will be steam-cleaned prior to use at the site. Following completion at the site investigative work, the equipment will also be steam-cleaned prior to leaving the site. When possible, the decontamination of tools, drilling rig, hollow stem augers, sampling equipment, and vehicles, will be performed in a designated area central to the work sites. Every attempt will be made to reduce contamination on equipment and articles to levels that are low as reasonably achievable.

EMERGENCY PROCEDURES

In the event of an injury, the SSO will evaluate the nature of the injury, initiate appropriate first aid, and contact Trinity Medical Hospital (309) 757-3232 for an ambulance if required. No person may re-enter the work area until the cause of the injury or symptoms is determined. The SSO will complete an accident report following the treatment of the injury. Emergency phone numbers and the hospital route are located in Tables 1 and 2, respectively. A map to the hospital is provided in Figure 1.

TABLES

TABLE 1. EMERGENCY TELEPHONE NUMBERS

HEALTH AND SAFETY PLAN
NAVISTAR/BNR/IIR PROPERTIES, ROCK ISLAND, ILLINOIS

AGENCY	GENERAL	EMERGENCY
Trinity Medical Hospital (East Branch)	(309) 757-3131	(309) 757-3232
Fire	(309) 793-3475	911
Police	(309) 793-3475	911
Ambulance	(309) 793-3475	911
Poison Control Center	(800) 543-2022	
USEPA 24-hour Spill Response	(312) 353-2318	
IEPA Emergency Response Unit	(217) 782-3637	
Geraghty & Miller, Inc. Chicago, Illinois	(312) 263-6703	
Geraghy & Miller, Inc. Physician GEO Health Associates	(312) 939-7939	
USEPA On-Scene Coordinator Beeper (PIN #5708136)	(312) 886-5296 (800) 759-8888	

CI0299.003\TBL_C-1.WP5

TABLE 2. HOSPITAL LOCATION AND ROUTE

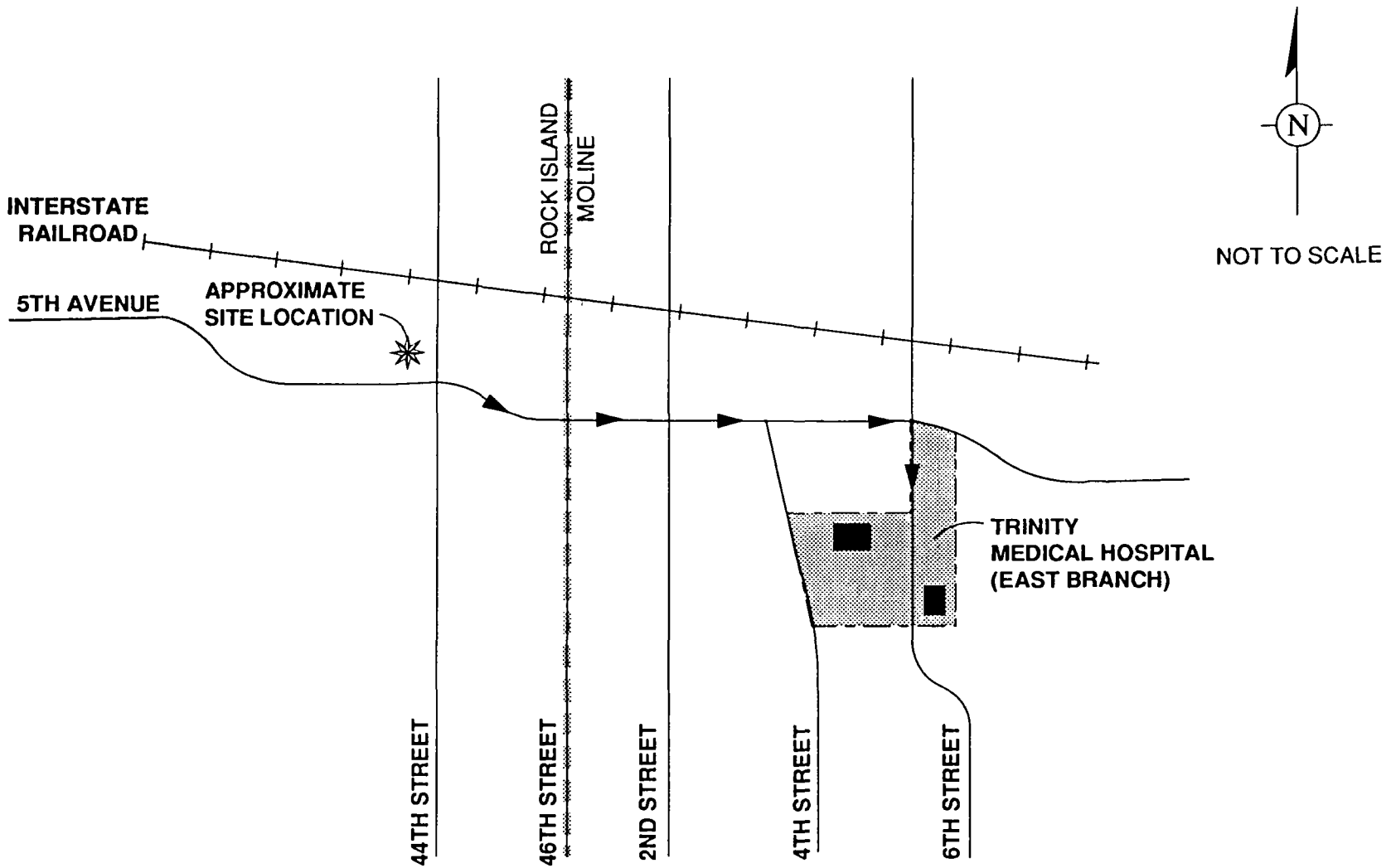
HEALTH AND SAFETY PLAN
NAVISTAR/BNR/IIR PROPERTIES, ROCK ISLAND, ILLINOIS

Take 5th Avenue east to Moline to 6th Street, which is a one-way street located up a hill and between two pavilions. Turn right (south) down 6th Street to reach the hospital area. Follow directional signs to Emergency.

CI0299.003\TBL_C-2.WP5

FIGURE

DWG DATE: 07JUN94	PRJCT NO.: CI0299.002	FILE NO.: 1343	DRAWING: 10	CHECKED: MMM	APPROVED:	DRAFTER: ELS



GERAGHTY & MILLER, INC.
Environmental Services

ROUTE TO TRINITY MEDICAL HOSPITAL (EAST BRANCH)

PHASE II SITE INVESTIGATION WORK PLAN
NAVISTAR/BURLINGTON NORTHERN RAILROAD
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

FIGURE
1

ATTACHMENT

ACETONE

Synonyms:	Dimethyl ketone, Ketone propane, 2-Propanone	
Threshold Limit Value (TLV):	250 ppm	
IDLH Level:	20,000 ppm	
Physical Description:	Colorless liquid with fragrant, mint-like odor	
Personal Protection and Sanitation:	Clothing:	Wear appropriate clothing to prevent repeated or prolonged skin contact
	Goggles:	Wear eye protection to prevent reasonable probability of eye contact
	Wash:	Workers should wash promptly when skin becomes wet
	Remove:	Remove clothing immediately if it becomes wet
Routes of Entry:	Inhalation, ingestion, skin and/or eye contact	
Symptoms:	Irritation of eyes, nose, and throat; headache and dizziness; dermatitis	
First Aid:	Eyes:	Immediately wash the eyes with large amounts of water. Get medical attention immediately.
	Skin:	Immediately wash with soap and water; if chemical penetrates clothing, remove clothing and wash with soap and water. Get medical attention immediately.
Target Organs:	Respiratory system, skin.	

BENZENE

Synonyms:	Benzol, Phenol hydride	
IDLH Level:	3000 ppm	
Physical Description:	Colorless to light-yellow liquid with an aromatic odor	
Personal Protection and Sanitation:	Clothing:	Wear appropriate equipment to prevent repeated or prolonged skin contact
	Goggles:	Wear eye protection to prevent reasonable probability of eye contact
	Wash:	Workers should wash promptly with soap when skin becomes contaminated
	Remove:	Remove clothing immediately if it become wet
Routes of Entry:	Inhalation, ingestion, skin/eye contact, skin absorption	
Symptoms:	Irritation of eyes, nose, respiratory system;giddiness; headache, nausea, staggered gait; fatigue, lassitude, anorexia; dermatitis, depression	
First Aid:	Eye:	Immediately wash the eyes with large amounts of water and continue flushing for 15 min., lifting eyelids. Get medical attention immediately
	Skin:	Promptly wash skin with soap and water
	Breath:	Move exposed person to fresh air at once; perform mouth-to-mouth resuscitation of breathing has stopped
Target Organs:	Skin, bone marrow, eyes, respiratory system, central nervous system	

2-BUTANONE

Synonyms:	Ethyl methyl ketone, MEK	
Threshold Limit Value (TLV):	200 ppm	
IDLH Level:	3000 ppm	
Physical Description:	Colorless liquid with moderately sharp fragrant, mint-like odor	
Personal Protection and Sanitation:	Clothing:	Wear appropriate equipment to prevent repeated or prolonged skin contact
	Goggles:	Wear eye protection to prevent reasonable probability of eye contact
	Remove:	Promptly remove any non-impervious clothing that becomes contaminated
	Provide:	Provide eyewash
Routes of Entry:	Inhalation, ingestion, skin/eye contact	
Symptoms:	Irritation of eyes and nose; headache; dizziness, vomiting	
First Aid:	Eyes:	Immediately wash eyes with large amounts of water
	Skin:	Immediately wash contaminated skin with water
	Breath:	Move exposed person to fresh air immediately
	Swallow:	Immediately get medical attention
Target Organs:	Central nervous system, lungs	

ETHYLBENZENE

Synonyms:	Ethylbenzol, Phenylethane	
Threshold Limit Value (TLV):	100 ppm	
IDLH Level:	2000 ppm	
Physical Description:	Colorless liquid with an aromatic odor	
Personal Protection and Sanitation:	Clothing:	Wear appropriate equipment to prevent repeated or prolonged skin contact
	Goggles:	Wear eye protection to prevent reasonable probability of eye contact
	Wash:	Wash promptly when skin becomes contaminated
	Remove:	Remove clothing immediately if it becomes wet to avoid flammability hazard
Routes of Entry:	Inhalation, ingestion,skin/eye contact	
Symptoms:	Irritation of eyes, mucous membranes; headache, dermatitis, coma	
First Aid:	Eyes:	Immediately wash eyes with large amounts of water
	Skin:	Promptly flush contaminated part with water
	Breath:	Move exposed person to fresh air immediately. Perform mouth-to-mouth resuscitation if breathing has stopped
	Swallow:	Get medical attention immediately
Target Organs:	Eyes, upper respiratory system, skin, central nervous system	

XYLENES

Synonyms:	Dimethylbenzene	
Threshold Limit Value (TLV):	100 ppm	
IDLH Level:	1000 ppm	
Physical Description:	Colorless liquids with an aromatic odor	
Personal Protection and Sanitation:	Clothing:	Wear appropriate equipment to prevent repeated or prolonged skin contact
	Goggles:	Wear eye protection to prevent reasonable probability of eye contact
	Wash:	Promptly wash if contamination occurs
	Remove:	Immediately remove any clothing that becomes wet to avoid flammable hazards
Routes of Entry:	Inhalation, ingestion, skin/eye contact, skin absorption	
Symptoms:	Dizziness, excitement, drowsiness; irritation of eyes, nose, and throat; nausea, vomiting; dermatitis	
First Aid:	Eyes:	Immediately wash eyes with large amounts of water
	Skin:	Promptly wash with soap and water
	Breath:	Move exposed person to fresh air at once. If breathing has stopped, provide mouth-to-mouth resuscitation
	Swallow:	Get medical attention immediately
Target Organs:	Central nervous system, eyes, gastrointestinal tract, liver, kidneys, skin	

POLYNUCLEAR AROMATIC HYDROCARBONS

Synonyms:	PNAs, PAHs, PPAHs, and POMs	
Threshold Limit Value (TLV):	0.2 mg/L	
Personal Protection and Sanitation:	Clothing:	Wear appropriate equipment to prevent repeated or prolonged skin contact
	Goggles:	Wear eye protection to prevent reasonable probability of eye contact
	Wash:	At the end of each work shift
	Remove:	Immediately remove any clothing that becomes contaminated
Routes of Entry:	Inhalation of particulates, vapors	

POLYCHLOROBIPHENYLS (PCB)

Synonyms:	Aroclor, Phenoclor
Threshold Limit Value (TLV):	1.0 ug/L
Routes of Entry:	Absorption
Symptoms:	Chloracne, impairment of liver, and neurobehavioral symptoms
Target Organs:	Skin, liver, central nervous system

LEAD

Synonyms:	Lead metal, plumbum	
Threshold Limit Value (TLV):	0.1 mg/L	
IDLH Level:	700 mg/L	
Physical Description:	Metal: a heavy, soft, grey solid	
Personal Protection and Sanitation:	Clothing:	Wear appropriate equipment to prevent repeated or prolonged eye contact
	Goggles:	Wear eye protection to prevent reasonable probability of eye contact
	Wash:	Wash at the end of each work shift
	Remove:	Immediately remove any non-impervious clothing that becomes contaminated
Routes of Entry:	Inhalation, ingestion, skin/eye contact	
Symptoms:	Weakness, lassitude; facial pallor; malnutrition, constipation, abdominal pain; tremors; irritated eyes; hypotension	
First Aid:	Eyes:	Immediately wash the eyes with large amounts of water and continue flushing for 15 minutes
	Skin:	Promptly flush contaminated skin with soap and water. If irritation persists after washing, get medical attention.
	Breath:	Move exposed person to fresh air immediately. Perform mouth-to-mouth resuscitation if breathing has stopped.
Target Organs:	Kidneys, blood, central nervous system, gastrointestinal tract	

1396navistar/atch.apc

GERAGHTY & MILLER, INC.
Environmental Services

Telecopier Transmittal Cover Sheet

Total Pages 8 **(Including Cover Sheet)**

To: JULIE ZAKUTANSKY **Date:** 07/18/94

Company: USEPA

Fax Number: ( ) 353 - 9176

Re: SYLVAN SLOUGH WORK PLAN

Project Name: _____ **Project No.:** CI0299.003

Proposal Name: _____ **Proposal No.:** _____

___ For Your Review
___ For Your Information
✓ As Requested

___ For Approval
___ Rush
___ Verify Report

Remarks:
I WILL MESSENGER COPIES TO YOU TOMORROW ALONG WITH THE HAZARD EVALUATION SHEETS.

THANK YOU

FROM: JIM KUSER
GERAGHTY & MILLER, INC.

35 East Wacker Drive, Suite 1000 • Chicago, Illinois 60601 • (312) 263-6703 • FAX (312) 263-7897

CONTENTS

3.2 AERIAL SURVEYING AND LOCATION AND ELEVATION SURVEYING

All monitoring wells completed as part of the Phase II Site Investigation will be surveyed to provide horizontal and vertical data control. Elevations will be surveyed to the nearest 0.01 ft relative to mean sea level (msl). Horizontal locations for each of the monitoring wells will be determined to the nearest foot. In addition, an aerial survey of the site and site vicinity will be conducted to develop a local site topographic map.

3.3 PHASE II SITE INVESTIGATION REPORT

Subsequent to completion of Phase II Site Investigation activities, a Phase II Site Investigation Report will be prepared. This report will describe the equipment, methods, and techniques used to perform the Phase II site investigation work and will include the raw data generated, an interpretation of the data, and recommendations for additional investigative or removal activities, as appropriate. As indicated in the order, Geraghty & Miller, on behalf of the Respondents, will also submit monthly progress reports to the USEPA. These reports will describe all significant developments during the preceding period, including the work performed and any problems encountered, analytical data received during the reporting period, and developments anticipated during the next reporting period, including a schedule of work to be performed, anticipated problems, and planned resolutions of past or anticipated problems.

3.4 DEVELOPMENT OF REMOVAL ALTERNATIVE

Based on the results of subsurface investigations conducted by previous investigators and the results of the Phase II investigation, Geraghty & Miller will conduct an engineering analysis of several potentially feasible source control alternatives for the Navistar/BNR/IIR Site. A brief description of Geraghty & Miller's technical approach for completing this task is presented in the following sections. An assessment of potentially available alternatives for the site, based on our preliminary review of the available site information is presented in Section 3.5.

Means Cost Estimating Guide, and unpublished data such as quotations from equipment vendors and service suppliers, and project notes.

The O&M costs cover post-installation activities required to operate the alternative, and include the costs for labor, parts, and other materials required to provide routine maintenance of equipment. Other O&M costs to be incurred include chemical and electricity needs for system operations, water and sewer service, and administrative costs.

3.5 PRELIMINARY ASSESSMENT OF POTENTIAL REMOVAL ACTIONS

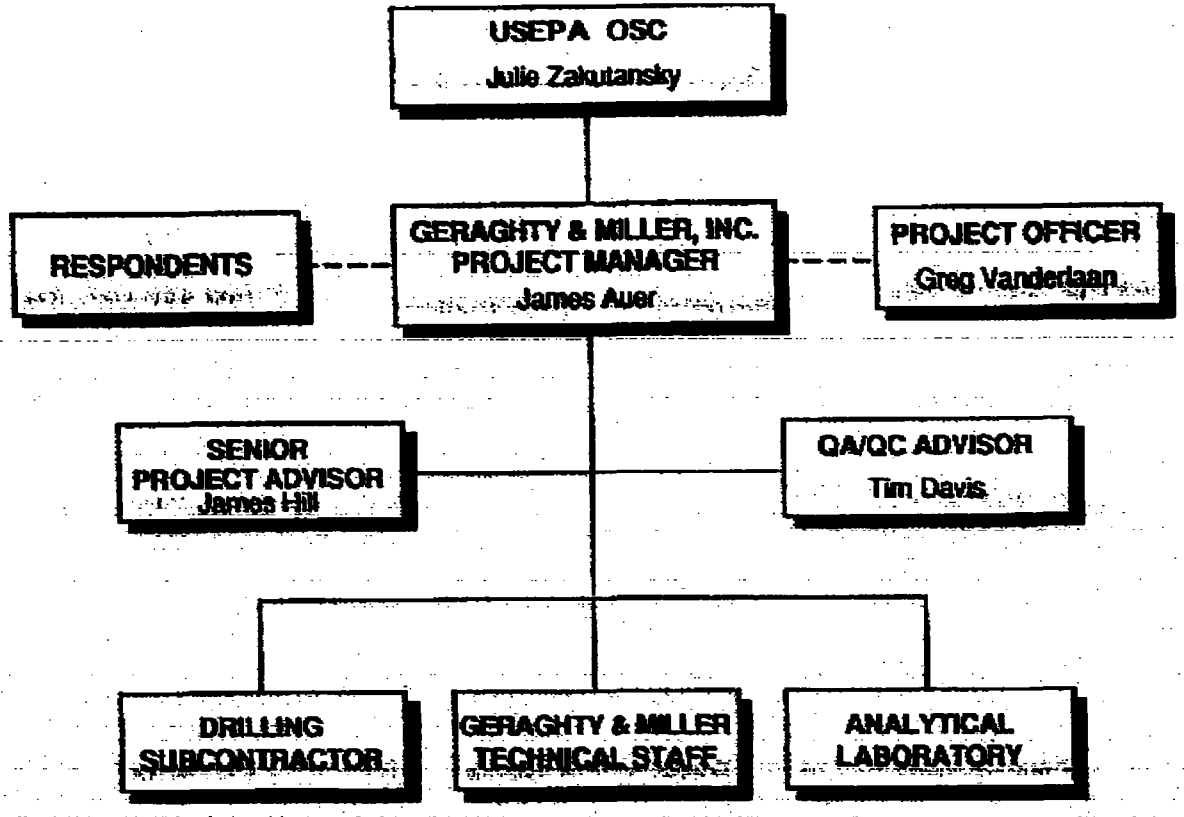
Based on a preliminary review of available site information, Geraghty & Miller has made an initial assessment of the type of removal action that may be appropriate at the Navistar/BNR/IIR Site. The discussion presented in this section is intended to provide the USEPA with an introduction to the types of technologies that will be considered in the alternatives evaluation, and the general guidelines for system selection. The assessments presented herein are preliminary in nature, and are subject to change based on the results of the additional data collection activities and the detailed alternatives evaluation.

3.5.1 Production Recovery System

Groundwater at the Navistar/BNR/IIR Site is believed to have been affected as a result of former site operations, notably a diesel fuel release from an aboveground storage tank. The results of previous groundwater sampling have revealed the presence of dissolved BETX (benzene, ethylbenzene, toluene, and xylene) and PNAs, along with a floating layer of hydrocarbons, or non-aqueous phase liquid (NAPL).

Active recovery of the NAPL would require an engineered system that includes each of the following elements:

- NAPL recovery.



GERAGHTY & MILLER, INC.
Environmental Services

PROJECT TEAM ORGANIZATION

PHASE II SITE INVESTIGATION WORK PLAN
NAVISTAR/BURLINGTON NORTHERN RAILROAD
IOWA INTERSTATE RAILROAD PROPERTIES
ROCK ISLAND, ILLINOIS

FIGURE
5-1

Table A3-1. Summary of Sampling and Analysis Program.

Sample Type	Field Measurements and Observations	Laboratory Parameters [2]	Analytical Method	DQO Analytical Level	# of Samples	QUALITY CONTROL SAMPLES # of Field Duplicates	# of Equipment Blanks	# of MS/MSD	Total # of Samples
Soil	- Organic vapor screening using PID or FID [1]	VOCs	8240	II	24	0	0	2	26
		PNAs	8310	II	24	0	0	2	26
		PCBs	8080	II	24	0	0	2	26
Groundwater	- pH	VOCs	8240	II	22	3	5	2	32
	- Specific Conductance	PNAs	8310	II	22	3	3	2	30
	- Temperature	PCBs	8080	II	22	3	3	2	30
	- Qualitative observation of color and turbidity								

1 PID/FID screening will provide qualitative information regarding the concentration of VOCs in the sample and provide information for health and safety purposes.

2 All water samples are unfiltered; VOCs = Volatile Organic Compounds; PNAs = polynuclear aromatic hydrocarbons; PCBs = polychlorinated biphenyls.

C10299.003\TBL-A3-1.XLS

- **Verification Objective (DQO Level 2):** This objective for data quality is available for data collection activities that require qualitative and/or quantitative verification of a "select portion of sample findings' (10% or more) that were acquired using non-rigorous methods of analysis and quality assurance. This quality objective is intended to give the decision-maker (Project Manager and/or OSC) a level of confidence for a select portion of the preliminary data. Generally the methods used for verification are more rigorous, as to analytical methodology and quality assurance. Only those verification methods that are analyte specific can be considered for this quality objective. This objective is generally applied, but not limited to, the following activities: physical and/or chemical properties of samples; extent and degree of contamination; verification of pollutant plume definition in groundwater; verification of health and safety assessment; verification of pollutant identification; and verification of cleanup. The soil and groundwater samples that will be submitted to the laboratory for analysis as part of the Phase II Site Investigation will follow the DQO Level 2 verification objective.

- **Definitive Objective (DQO Level 3):** This objective for data quality is available for data collection activities that require a high degree of qualitative and quantitative accuracy of all findings using rigorous methods of analysis and quality assurance for "critical samples" (i.e., those samples for which the data are considered essential in making a decision). This quality objective is intended to give the decision maker (Project Manager or OSC) a level of confidence for a select group of "critical samples" such that a decision can be made based on an action level with regard to: treatment; disposal; site remediation and/or removal of pollutants; health risk or environmental impact; cleanup verification; pollutant source identification; delineation of contaminants; and other significant decision where an action level is concerned. Only those methods that are analyte specific can be used for this quality objective. No DQO Level 3 data will be collected during the Phase II Site Investigation.

Table B1-1. Summary of Samples and Matrices.

Sample Type	Field Measurements and Observations	Laboratory Parameters [2]	Analytical Method	DQO Analytical Level	# of Samples	QUALITY CONTROL SAMPLES # of Field Duplicates	# of Equipment Blanks	# of MS/MSD	Total # of Samples
Soil	- Organic vapor screening using PID or FID [1]	BETX	8240	II	20	0	0	1	21
		PNAs	8310	II	20	0	0	1	21
		PCBs	8080	II	20	0	0	1	21
Groundwater	- pH - Specific Conductance - Temperature - Qualitative observation of color and turbidity	BETX	8240	II	20	2	4	1	27
		PNAs	8310	II	20	2	2	1	25
		PCBs	8080	II	20	2	2	1	25

1 PID/FID screening will provide qualitative information regarding the concentration of VOCs in the sample and provide information for health and safety purposes.

2 All water samples are unfiltered; BETX = benzene, ethylbenzene, toluene and xylenes; PNAs = polynuclear aromatic hydrocarbons; PCBs = polychlorinated biphenyls.

CI0299.003\TBL-B1-1.XLS